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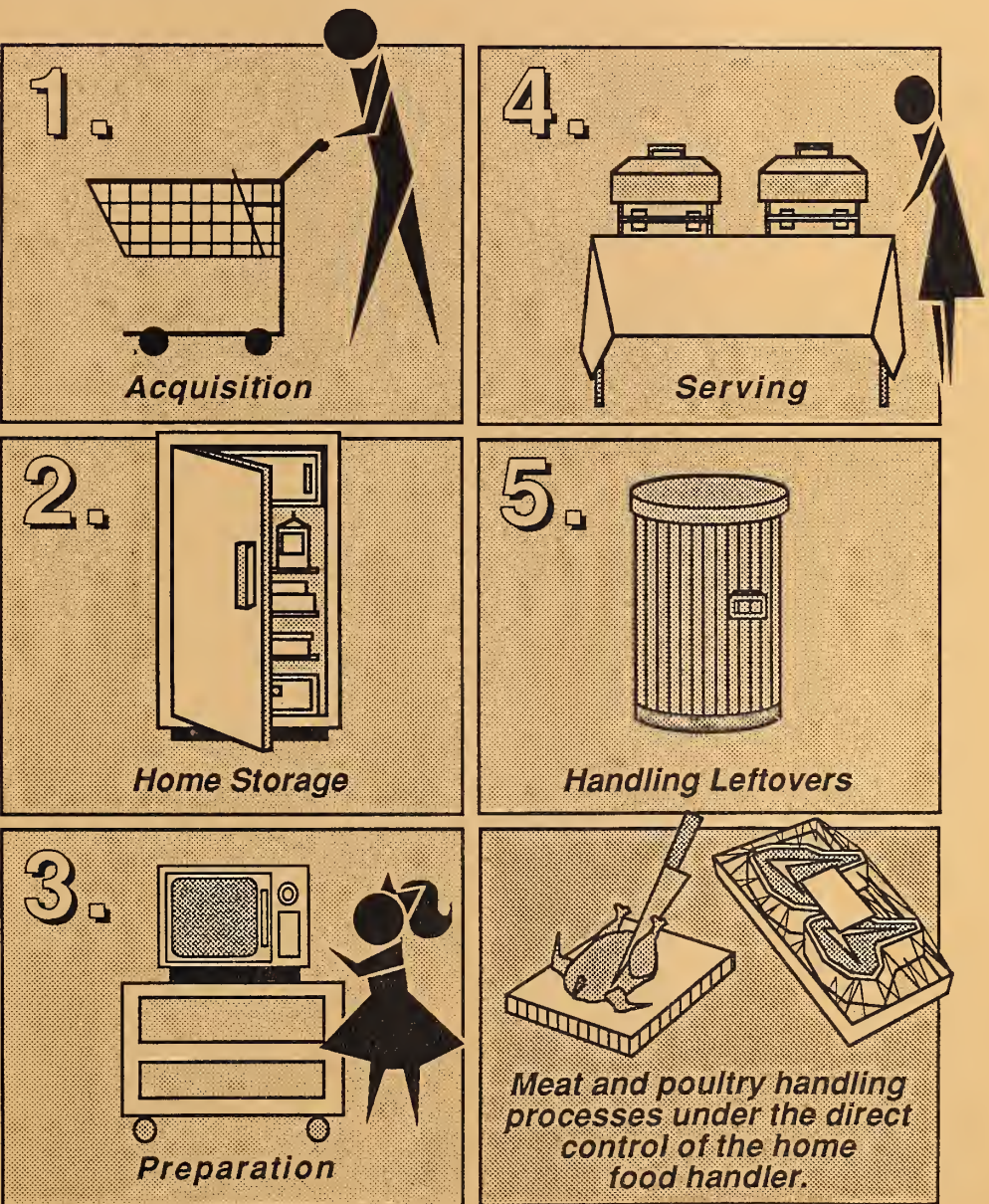
Information and
Legislative Affairs

June 1989

A Margin of Safety: The HACCP* Approach to Food Safety Education

Project Report

*Hazard Analysis of
Critical Control Points



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Foreword

Between the autumn of 1987 and the winter of 1989, the working group on risk-based food safety education synthesized information from a literature search and several surveys of experts in a reassessment of the appropriate content of Food Safety and Inspection Service (FSIS) education programs for home food handlers. This was done, in part, in response to a suggestion of the National Academy of Sciences that FSIS food safety education programs might be more "systematic."

Hazard Analysis of Critical Control Points (HACCP) theory involves taking a closer look at a process to determine the critical control points. The critical control points are those where a failure to take an appropriate action will be most likely to jeopardize the outcome or product of the process. Using the most objective measures available, the group sought to apply this approach to food safety education -- to determine educational critical control points, or the behaviors most important in preventing meat- or poultry-borne illness, but least understood.

The first use of the project results will be a new consumer education publication to supplement the popular Safe Food Book. Project results will also be used in the revision of the latter publication, which FSIS will target primarily to "information multipliers" such as Extension agents, teachers, local health officials, and journalists. Finally, FSIS will continue to use a more systematic, risk-based approach in future food safety education programs.

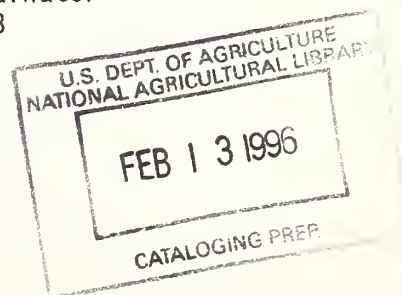
This project does not downplay the importance of microbial contamination, which is a critical control point in the prevention of bacterial foodborne illness. FSIS has many times expressed its policy that the animal production and food processing industries must work together to control and reduce the frequency of microbial contamination throughout the food chain.

Nevertheless, microbial contamination of raw products should not be portrayed as the single most important control point in preventing illness. Food handling practices almost always determine whether microbial contamination on raw products results in foodborne illness.

Today, almost all cases of bacterial foodborne illness could be prevented by careful food handling. If microbial contamination on raw foods of animal origin is significantly reduced (it cannot be eliminated unless foods are sterilized), careful food handling will still be necessary to prevent bacteria from surviving, reproducing, or, in some cases, forming toxin.

Readers interested in more information about this project may request a copy of the full report and appendices from:

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Working Group on Risk-Based Food Safety Education

"Margin of Safety" summarizes a project coordinated by the Information and Legislative Affairs Staff (ILA) of the Food Safety and Inspection Service between the autumn of 1987 and the winter of 1988-89. It involved the time and expertise of professionals from several other FSIS staffs, including Science, Technical Services, and the Policy and Planning Staff. The core group responsible for the analysis and report includes:

Sharin Sachs, project coordinator (senior public affairs specialist, Information Office, ILA)
Carl Custer, chair, microbiology subcommittee (staff officer, Processed Products Division, Technical Services)
Priscilla Levine, microbiology subcommittee (microbiologist, Microbiological Monitoring and Surveillance Branch, Microbiology Division, Science)
Martha Workman, microbiology subcommittee (food technologist, Nutrition Branch, Food Ingredient Assessment Division, Science)
Marjorie Davidson, chair, public awareness subcommittee (assistant chief, Public Awareness Office, ILA)
Sara Fein, survey analyst (program analyst, Policy Analysis Unit, Policy and Planning Staff)
Milton Goldsamt, questionnaire design (formerly program analyst, Policy Analysis Unit, Policy and Planning Staff)

The work of many other individuals helped to shape the project and to assure that results are applicable to the food safety education programs of the Food Safety and Inspection Service. First, of course, are the experts who took time out of their busy schedules to complete the survey questionnaires and to provide honest, thoughtful comments. The experts include several members of the National Advisory Committee on Microbiological Criteria for Foods, whose interest in the project is greatly appreciated; eleven experienced microbiologists in government, academia, and the private sector; seven knowledgeable consumer advisors in government, industry, and the private sector; and three epidemiologists with the FSIS Meatborne Hazard Control Center.

Susan Templin, coordinator of USDA's Tollfree Meat and Poultry Hotline, and several members of her staff helped develop the inventory of advice statements and offered useful suggestions throughout the course of the project. Jane Roth, director of the Policy Analysis Unit, provided many pertinent, concise suggestions for professionally sound analysis. Dr. Catherine Adams, special assistant to the Administrator, FSIS, participated in designing and pretesting the survey instrument. Jody Siegel, formerly with the Public Awareness Office, helped shape the conceptual design of the project. Laura Fox, chief of the Public Awareness office, and Karen Stuck, chief of the Information Office, offered many useful suggestions. Finally, Patricia Drayne, deputy director of Information and Legislative Affairs, quietly and consistently provided sound guidance and sage advice on all aspects of the project.

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EXECUTIVE SUMMARY

A Margin of Safety: Preventing Foodborne Illness Through Food Safety Education

Background. An estimated 6.5 to 81 million cases of foodborne illness occur each year. (No one knows how much foodborne illness actually occurs.) At least 25 percent of reported foodborne illness outbreaks could have been prevented solely by safe food practices. In about 25 percent of preventable outbreaks of foodborne illness, a meat or poultry product was the food "vehicle" for the bacteria that caused illness.

Foods don't cause illness; bacteria and other pathogens do. However, raw foods of animal origin -- meat, poultry, eggs, fish, shellfish -- frequently are contaminated with Salmonella or other bacteria common in the food chain. In other cases, healthy food handlers may contaminate food with Staphylococcus aureus or other bacteria common in the human body, or diseased food handlers may contaminate food with less common pathogens.

Whether raw foods are contaminated at the time of purchase, or purchased foods are contaminated by food handlers, over time, mishandling can allow bacteria to survive, reproduce, or (in some cases) form a toxin in food or the human body. In short, food handling errors are almost always directly associated with the "dinner-plate" microbial contamination that is a prerequisite for foodborne illness.

A 1983 survey found that consumers rate homes last as a place where food safety concerns occur. Indeed, more reported outbreaks are traced to commercial foodservice settings than to either homes or food processing establishments. However, between 1973 and 1982, home food mishandling contributed to at least 345 outbreaks of foodborne illness. (Except for botulism, an outbreak usually affects at least two persons.)

It is widely acknowledged that education of food handlers (in all food handling settings) can reduce foodborne illness by positively influencing behavior. That is because careful food handling provides a wide margin of safety from foodborne illness. However, the seemingly straightforward task of food safety education is more complicated than it may first appear.

In one of many activities to increase the effectiveness of food safety education, the Working Group on Risk-based Food Safety Education in 1987 and 1988 reassessed the focus of the Food Safety and Inspection Service's educational outreach programs for home food handlers.

Goals

- Support sound educational priorities and objectives;
- Contribute to the future revision of all ILA consumer education materials, including such major publications as the Safe Food Book; and
- Respond to the NAS recommendation that ILA food safety education programs be more "systematic."

Objectives

-Define the meat and poultry handling process under the direct control of the home food handler, including all specific behaviors known or believed to be important in preventing bacterial and parasitic foodborne illness (the preventable foodborne illnesses);

-Determine the specific behaviors most important in preventing meat or poultry-borne illness, and least understood or practiced.

Method

The group (a) conducted a literature search, including a survey of surveys on consumer knowledge and practice of important food safety practices; (b) surveyed 11 selected microbiologists with an average of 22 years' experience and 10 members of the National Advisory Committee on Microbiological Criteria; and (c) surveyed 7 consumer experts.

Microbiology experts were asked to assess the risks of not performing about 77 behaviors known or believed to be important in preventing foodborne illness, for two product categories (raw or partially cooked, fully cooked). Consumer experts were asked to assess home food handler knowledge and practice of the behaviors. All information on knowledge and practiced was analyzed and cross-referenced.

Findings

Handling practices. The working group synthesized the information from the literature search and surveys of microbiology experts to develop a list of meat and poultry handling practices most important in preventing foodborne illness. (See "Red Light, Yellow Light," following the executive summary.)

Knowledge and practice. The working group synthesized the information from the literature search and survey of consumer experts to summarize apparent food handler knowledge and practice of meat and poultry handling behaviors most important in preventing foodborne illness. (See Tables 1 and 2 and Appendix D.)

Available epidemiological information shows where some of the mistakes were made.

-Undercooking was a factor in 108 (31.3%) of 345 home outbreaks of foodborne illness that occurred between 1973 and 1982 (involving all foods, not just meat and poultry).

-Improper cooling was a factor in 77 home outbreaks (22.3% of the 345).

-Cooking foods ahead -- 12 or more hours before serving -- was a factor in 44 home outbreaks (12.8% of the 345). (Cooking ahead in itself is not a mistake. In the 44 outbreaks, at least one other mistake must have been made -- such as undercooking -- that allowed bacteria to survive. The time lag between preparation and serving simply allowed bacteria more time to reproduce or, in some cases, form toxin.)

(Source: "Risks of Practices, Procedures and Processes that Lead to Outbreaks of Foodborne Diseases," Dr. Frank Bryan. Journal of Food Protection (Vol. 51, No. 8), August 1988. Also see Table 6.)

Recent consumer survey results provide a perspective on both home food handler knowledge and practice of several handling steps important in preventing bacterial foodborne illness.

- About 25 percent of home food handlers would only rinse or wipe their hands after handling raw meat or poultry.

- About 25 percent would only rinse or wipe a cutting board or knife after use with raw meat or poultry.

- 27 percent of home food handlers would thaw a turkey on the counter.

- 44 percent never use a meat thermometer or pop-up timer.

- 25 percent would serve undercooked (rare or pink) hamburgers.

- 14 percent would leave cooked food at room temperature more than 2 hours.

- 67 percent would refrigerate cooked food in the cooking pot or one large container.

- 12 percent think fried chicken left on counter overnight would be safe to eat without reheating; 14 percent think reheating would make it safe to eat.

(Source: Preliminary results from 1988 FDA Health and Diet Survey Cycle IV)

Unfortunately, little objective, current information is available on consumer food safety knowledge and practice. However, surveyed consumer experts believe that more than half of American home food handlers do not understand or practice several food handling steps that are crucial in preventing foodborne illness.

Themes that Deserve More Emphasis in Food Safety Education

The group identified a list of themes appropriate for greater emphasis in FSIS educational programs, based on (1) the risk of not performing the practice and (2) the knowledge and practice of home food handlers. (Also see "Red Light, Yellow Light," and Tables 1 and 2.)

Most striking is the need for greater emphasis on practices that promote rapid, even cooling; specifically, using shallow containers and breaking roasts or other large cuts into smaller pieces. Improper cooling is the most common mistake made in all foodborne illness outbreaks -- not just in homes, and not just involving meat or poultry.

Two improper cooling behaviors predominate: leaving cooked foods at room temperature too long, and refrigerating foods in large, deep containers. A nationwide survey of consumers with telephones shows that 67 percent would refrigerate cooked foods in the cooking pot or one large container, and 14 percent would leave cooked foods at room temperature for more than 2 hours.

If all food safety educators emphasized rapid, even cooling for the next year, the project team believes this single action could significantly reduce preventable foodborne illness, by positively affecting food handler behavior.

The following is a list of other themes that warrant more attention in FSIS food safety education materials, based on project results.

The most important food handling behaviors are those which will, most of the time, protect most consumers from the most serious foodborne illnesses.

Every failure to perform an important food handling behavior increases the risk of foodborne illness.

The importance of safe food handling increases for food consumers who are very young, very old, ill, malnourished, or whose immune systems are weakened. [FSIS has begun an educational campaign directed toward consumers in these high-risk categories.]

Separate raw meat or poultry (or fish, or eggs) from cooked foods or foods that will be eaten without further cooking.

Report food safety problems.

Cool hot foods fast and evenly.

It is risky to eat any food of animal origin either raw or rare.

It may be even riskier to eat cooked foods that have been left out too long, cooled too slowly, or incompletely reheated.

Fast cooking: Take special precautions to ensure even, complete cooking and reheating in microwave ovens.

Slow cooking: Take special precautions to ensure even, complete cooking in slow cookers and smokers.

A meat thermometer or microwave temperature probe is the best "cue for doneness." Without one, check for clear-running juices and the absence of pink in the center of meat or poultry.

Refrigeration and freezing do not destroy bacteria, and, therefore, cannot cancel out other mistakes such as incomplete cooking or leaving cooked foods out too long. Take special care with leftovers, or when preparing foods ahead for later serving.

What to do when the power goes out -- on refrigerators, freezers, and freezer compartments.

If the recipe, product cooking instruction, or appliance direction seems unwise -- check it out. Call the Tollfree Meat and Poultry Hotline at 1-800-535-4555, 10 a.m. to 4 p.m., EST. TDD-accessible.

Care labeling. Project results suggest that more manufacturers may wish to consider adding "care labeling" -- that is, cooking and storage instructions -- to all products that require refrigeration before or after opening. Although experts did not agree on the impact care labeling would have on proper food handling and a subsequent reduction in foodborne illness, almost all believe that cooking and storage instructions on product labels would have a positive effect. (FSIS policy requires "special care" labeling on certain type of products, such as those that require refrigeration.)

Open dating. Open dating appears to be evolving from a quality issue to a time-temperature safety issue, particularly for ready-to-eat refrigerated foods. FSIS encourages refrigerated storage at 40 degrees F or lower, and encourages States to enforce open dating requirements. Some companies are now experimenting with time-temperature monitors in conjunction with open dating.

Food safety issues. The project on risk-based food safety education asked two groups of food safety experts to identify the greatest microbiological food safety concerns of the next five years. The groups identified several important concerns (in approximate priority order).

- | | |
|---|---------------------------------|
| (1) <u>Salmonella</u> | (6) Partially cooked products |
| (2) <u>Listeria monocytogenes</u> | (7) Refrigerated products |
| (3) <u>Training of commercial</u> food handlers | (8) <u>Campylobacter jejuni</u> |
| (4) Education of home food handlers | (9) <u>E. coli</u> 0157:H7 |
| (5) Products in vacuum, mixed-atmosphere,
or other novel packaging | |

(Also see Table 8.)

RED LIGHT, YELLOW LIGHT: ESSENTIAL AND ADVISED BEHAVIORS TO PREVENT FOODBORNE ILLNESS FROM MEAT OR POULTRY

The following handling practices are important in preventing foodborne illness because they prevent or control the "dinner-plate" microbial contamination intrinsically associated with foodborne illness. The practices are under the direct control of the consumer, from food acquisition through disposal.

If colors were used, a red light by "essential" behaviors would signify that the risk of foodborne illness is high until the behavior is carried out. A yellow light by "advised" behaviors would signify that food handlers may be taking a risk of foodborne illness if the behavior is not carried out.

PROCESS 1



Essential:

***Keep packages of raw meat and poultry separate from other foods, particularly foods that will be eaten without further cooking.** For example, use plastic produce bags on fresh fruits and vegetables. Consider using plastic bags to enclose individual packages of raw meat and poultry. Avoid placing raw meat or poultry in the cart in a manner that will allow fluids to drip on other foods.

***Buy packaged precooked foods only if packaging is sound; for example, no tears in packaging.**

***Buy products labeled "keep refrigerated" only if they are stored in a refrigerated meat case.**

***Buy unpackaged meat or poultry from deli refrigerated cases only if not in contact with other foods.**

***Shop for meat and poultry last. Within 2 hours, serve, reheat, refrigerate or freeze cooked foods — within 1 hour if it's hot out.**

***Report problems with packaging, product, storage, sanitation to store management. If still unsatisfied, report problem to local health authorities.**

Advised:

#Buy open-dated products only if label sell-by, use-by or pull-by date has not expired. (If asked today, many experts would rate this as a critical food handling behavior.)

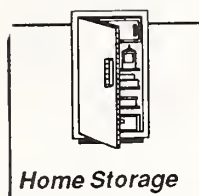
#Plan ahead to make sure you have enough refrigerator or freezer space for your meat and poultry purchases.

#Buy foods from reputable source with no known record of unsafe handling.

#Buy frozen products only if they appear frozen to the touch.

#Pack raw foods in an ice chest if time from store to home refrigerator will be more than 1 hour.

PROCESS 2



Refrigeration

Essential:

***Keep raw meat or poultry separate from other foods, particularly those that will be eaten without further cooking. Use plastic bags or aluminum foil over commercial packaging on meat or poultry, or place product on plate, to prevent raw juices from dripping on other foods or refrigerator surfaces.**

***Refrigerate products with "keep refrigerated" labels.**

***If refrigerator fails, keep door closed and, within a few hours, cook products or place in environment 40 degrees F or colder.** Because refrigerator and climate conditions may vary a great deal, call the Tollfree Meat and Poultry Hotline for specific advice in your situation.

Advised:

#Use refrigerator thermometer to verify temperatures of 40 Degrees F or colder.

#Maintain a clean refrigerator.

#Wash hands with soap and water for 20 seconds before rewrapping products whose packaging was damaged during transport.

#Use undated products within a safe time limit that will also assure quality. Dating undated products at home is a good idea.

Freezing

Essential:

***If freezer fails, keep door closed. Within 1 to 2 days, refreeze meat and poultry with ice crystals. If freezer compartment fails, keep door closed and find another cold source within a few hours, OR cook and serve the product.** Because freezer and climate conditions can vary a great deal, call the Tollfree Meat and Poultry Hotline for specific advice if this happens to you.

Advised:

#Freeze foods with a "keep frozen" label.

#Use freezer wrap, freezer-quality plastic bags, or aluminum foil over commercial wrap on products for the freezer.

#Wash hands with soap and water for 20 seconds before rewrapping product whose packaging was damaged in transit.

PROCESS 3



Preliminaries

Essential:

***Wash hands (gloved or not) with soap and water for 20 seconds before beginning preparation, after handling raw meat or poultry, after touching animals, using bathroom or changing diapers.**

***Don't let juices from raw meat or poultry come in contact with any other food, raw or cooked. Wash your hands, counters, equipment, and utensils with soap and water immediately after use.** (Examples: Acrylic cutting boards are easier than wooden cutting boards to keep clean; don't reuse marinades.)

***Thaw only in refrigerator, under cold water changed every 30 minutes, or in microwave (followed by immediate cooking).**

***Stuff raw product immediately before cooking.** USDA advises against purchase of fresh, prestuffed whole poultry. USDA advises purchase of fully cooked, prestuffed whole poultry only if it will be served within 2 hours after purchase.

***Don't taste meat or poultry when it's raw or during cooking.** (Or eggs, fish or shellfish -- any raw food of animal origin.)

Advised:

#Sneeze away from food.

#Marinate raw products in the refrigerator, not on the counter.

#Wear clean plastic glove over skin cut, particularly when handling cooked products.

Initial Cooking or Reheating by Consumer

(Cooking raw products)

Essential:

***Use meat thermometer to judge safe internal temperature of meat and poultry over 2 inches thick (160 degrees F or higher for meat, 180 degrees F or higher for poultry). If your microwave has a temperature probe, use it.** In conventional cooking, particularly for consumers without meat thermometers, USDA advises oven temperatures of 325 degrees F or above. For microwaving, USDA advises consumers to cover raw meat and poultry, and to check temperature of microwaved meat and poultry in at least three spots.

***For meat or poultry less than two inches thick, look for clear juices and lack of pink in the center as signs of "doneness."**

***When using Crockpots[®], smokers, or slow cookers, USDA advises consumers to start with fresh rather than frozen, chunks rather than roasts or large cuts, and to be sure the recipe includes a liquid. Also, check internal temperature in three spots to be sure food is thoroughly cooked to 160 degrees F.**

PROCESS 3: PREPARATION, continued

***Avoid interrupted cooking.** Never refrigerate partially cooked products to finish cooking them on grill or in oven later. USDA also advises against recipes that call for "cooking without a heat source." For example, boiling water, inserting poultry, turning off water; preheating oven to 500 degrees F, inserting roast, turning off oven.

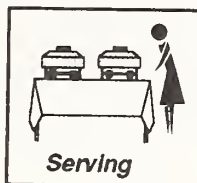
(Both cooking raw products and reheating processed products)

***If microwave cooking instructions on product label are not appropriate for your microwave, increase microwave time for product to reach safe internal temperature.**

***Use rotating microwave pad or rotate foods manually during microwaving.**

***Let microwaved food stand for recommended number of minutes before serving.**

PROCESS 4



Serving

Essential:

***Wash hands with soap and water before serving or eating food. Serve cooked products on clean plates and with clean utensils and clean hands.** For example, never put barbecued chicken back on the platter that held raw chicken.

Advised:

#Avoid dipping personal spoon in serving dish.

Hot Holding

Essential:

***Hold hot food above 140 degrees Fahrenheit.**

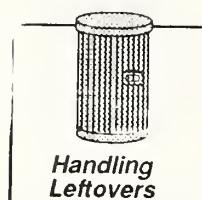
Room temperature holding

Essential:

***In environmental temperatures 90 degrees F or warmer, leave out cooked food no longer than 1 hour before reheating OR refrigerating or freezing.**

***In environmental temperatures below 90 degrees F, leave out cooked food no longer than 2 hours before reheating OR refrigerating or freezing.**

PROCESS 5



Cold Storage

Essential:

***Wash hands before handling leftovers and use clean utensils and surfaces.**

***Remove stuffing before cooling or freezing.**

***Refrigerate or freeze cooked leftovers in small, covered, SHALLOW containers within 2 hours after cooking. Leave airspace around containers to help assure rapid, even cooling.** Home economists with the Tollfree Meat and Poultry Hotline suggest using containers 3 inches deep or less -- the depth of a cake pan or pie dish.

***Avoid tasting old leftovers to determine safety.**

Advised:

#Date leftovers to allow use within safe time period.

Reheating Cooked Leftovers

Essential:

***If reheating leftovers, cover and reheat to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, "wet" foods; 165 degrees F for all others).**

Disposal of Leftovers

Essential:

***If in doubt, throw it out. Discard outdated, unsafe or possibly unsafe leftovers in garbage disposal or in tightly wrapped packages that cannot be consumed by people or animals.**

PROJECT SUMMARY

This section describes why the ILA working group on risk-based food safety education initiated its project to assess the appropriate content of FSIS education programs for home food handlers. It also describes how the ILA working group defined objectives and designed and conducted the project.

NAS recommendations. The 1985 and 1987 reports of the National Academy of Sciences (NAS) on meat and poultry inspection suggested that FSIS food safety education programs might be more "systematic." The 1987 report on poultry inspection recommended that FSIS apply a risk-assessment approach to all activities and presented a framework for Hazard Analysis of Critical Control Points (HACCP) analysis.

The report fell short of recommending such an approach for food safety education, although NAS suggested epidemiological follow-up in a contained area as a measure for determining the effectiveness of education.

HACCP analysis implies taking a closer look at the seemingly obvious. To use the HACCP analytical approach, one first outlines all the steps in a process -- whether the process is mailing holiday cards or making cured ham. Next, one assesses the risks of not taking action at each of the steps. Steps whose nonperformance makes the most difference to the outcome of the process are the "critical control points." For example, failure to place stamps on the envelopes would abort the entire process of mailing holiday cards. Failure to add a curing solution is a critical control point in the process of curing ham.

Issues Management. Annually, Information and Legislative Affairs staff in FSIS break into small working groups to analyze ways to improve public information activities in various issue areas. In the summer of 1987, an issues management group recommended that FSIS **redefine our food safety messages by adopting a HACCP approach, identifying points where food handler action could prevent illness, and focusing education on those points.**

Background. Food safety education has long been recognized as an important component of solving the problem of preventable foodborne illness. Education was a recommendation of the first National Academy of Sciences report on Salmonella published in 1969.

Yet, education is a very difficult matter. This can be seen by looking back at campaigns to educate communities on the usefulness of fluoridated water in preventing tooth decay, efforts to educate drivers on the importance of seatbelts in reducing highway fatalities, and work to educate physicians to check their patients for the early warning signs of cancer. Even when the audience absorbs the knowledge, behavioral change does not always follow.

Information overload. One reason education is so difficult is information overload. When a variety of experts are transmitting a large number of overlapping or even conflicting messages, they may sabotage their joint desire to positively influence behavior.

In the food safety arena, the problem is an increased incidence of foodborne illness. Some food safety messages transmitted by credible sources may be too complex to be quickly understandable ("Avoid cross-contamination"). Some may be too strict to be taken seriously ("Never cook raw meat or poultry in a microwave"). Some messages may require too much effort ("Always use a meat thermometer to judge doneness of roasts and other large cuts").

And finally, public policy debate over the causes of the problem ("better reporting," "more microbial contamination on raw products," "more older and immunocompromised individuals," "poorer state and local enforcement of foodservice health codes," "more virulent bacteria in the environment," "lack of national foodservice codes," "regulators too close to the regulated") may have deflected attention away from the principles of safe food handling that all in the debate advocate as part of the solution.

Personal risk assessment/management. Another reason that education is so difficult is that consumers individually assess risk and determine risk management strategies -- and in a much different manner than the experts. It is well-established that the less control a consumer believes he or she has over a risk, the greater the risk is perceived to be. The greater the risk is perceived to be, the more conservative the risk management strategy is likely to be.

Some consumers who saw the memorable 60 Minutes episode on Salmonella in 1987 may have needlessly eliminated a lean source of poultry from their diets, because they perceived eating chicken as a significant risk -- and a risk they did not wish to take. Others buy "free-range" chicken because they perceived the risk as eating mass-produced chicken.

Those seeking a simpler risk management strategy make sure to cook chicken thoroughly, to put cooked chicken on a clean plate, and to cut it with a clean knife: all behaviors under the complete control of the home food handler.

Even so, all three types of consumers might continue to enjoy steak tartare and raw oysters, not realizing that the principle of thorough cooking, as a foodborne illness preventive, applies to all raw foods of animal origin.

These possible responses to messages involving risk show why the discipline of risk communication is needed. This new field of study has developed in recent years in response to the complexity of communicating clearly, honestly, and effectively on issues that involve scientific uncertainty and strong human emotions.

FSIS food safety education. Over the past 20 years, FSIS food safety education activities have focused on commonly accepted food safety principles. The program has been effective -- in terms of consumer questions answered, publications distributed, professional recognition, and awards won.

However, Information and Legislative Affairs believes that food safety education, like all FSIS functions, should be public-health-based. Thus, the true test of effective education is whether it positively influences food handler behavior, thereby reducing preventable foodborne illness.

This requires a reassessment of the message itself, as well as the risk communication variables that may have influenced home food handlers' behavior.

The established principles of food safety have been reiterated many times: avoidance of cross-contamination, good personal hygiene and sanitation, thorough cooking, rapid and even cooling.

But which of the food handling behaviors that carry out a principle are truly most important in preventing foodborne illness? And at what points in the food handling process? For example, is failure to rotate foods in microwave ovens contributing to undercooking -- a frequent factor in outbreaks of foodborne illness? Do consumers frequently put barbecued chicken back on the platter with raw juices, which is a form of cross-contamination?

Does FSIS advice stress the behaviors that make the most difference in preventing the "dinner-plate" microbial contamination intrinsically associated with foodborne illness? Or is it possible that advice places too much emphasis on too many behaviors that have little or no effect on microbial contamination, or are universally practiced, to the neglect of behaviors that are not well-understood or even recognized as important?

In an effort to ensure that FSIS food safety advice is valid, is presented in specific behavioral terms, and is understandable and reasonable, ILA decided to reassess the content of the FSIS food safety education program.

Working group establishment. In late 1987, ILA formed a working group to apply the recommendation made by the issues management group earlier in the summer. Representatives from ILA (including tollfree Meat and Poultry Hotline staff), Science, Technical Services, and the Policy Analysis unit participated in several discussions. Over about a month's time, a core group developed goals, specific objectives, and a conceptual design for the project.

Goals

- Support sound educational priorities and objectives;
- Contribute to the future revision of all ILA consumer education materials, including such major publications as the Safe Food Book; and
- Respond to the NAS recommendation that ILA food safety education programs be more "systematic."

Objectives

- Define the meat and poultry handling process under the direct control of the home food handler, including all specific behaviors known or believed to be important in preventing bacterial and parasitic foodborne illness -- the preventable foodborne illnesses;
- Determine the specific behaviors most important in preventing meat or poultry-borne illness, and least understood or practiced.

Home food handler. For the purposes of this project, the group defined the home food handler as a consumer with the following characteristics: reads at the 10th grade level or above; typically buys a range of raw and processed meat and poultry products, prepares food for self and may prepare food for others in the household; owns a refrigerator with a freezer compartment, a conventional oven, and microwave.

The working group realizes this definition excludes many home food handlers, including children who do not read at the 10th grade level, as well as adult consumers who read at a lower level or who read well in a language other than English. However, to include literally all food handlers would have added too much difficulty to an already complex project. The working group recognizes that all food handlers could benefit from food safety education, and that communicating with children and other subgroups presents special challenges.

Process under direct control of home food handler. To develop the inventory of behaviors under the control of the home food handler, the working group chose as a starting point the five-stage model for risk assessment presented in the 1987 National Academy of Sciences report on poultry inspection. The food handling process under the control of the home food handler overlaps the distribution and consumption submodels suggested in the report. (See following page.) It begins when food is acquired, usually but not always at a grocery store. It ends when leftovers are disposed of.

Next, the group held a brainstorming session attended by several experienced home economists on the staff of the tollfree Meat and Poultry Hotline. A record was made of some of the most common questions recalled, the misconceptions apparent in some questions, and the advice given in response to these questions. Next, after meeting with an FSIS staffer involved in developing the Inspection System Work Plan, the group structured the inventory of recommended advice into five sequential major processes, each with one or more control "zones." Each control zone included one or more specific behaviors presented as much as possible in positive terms -- "do this," rather than "don't do that."

From the very beginning, the group used a behavioral approach rather than a commodity approach. For example, "within 2 hours after cooking, refrigerate cooked meat or poultry in small, shallow, covered containers" rather than, "be especially careful to refrigerate ham within 2 hours after serving." However, the group also wanted to address behaviors relevant to the range of meat and poultry products that might be handled in a home setting; for example, takeout pizza, raw hamburger, refrigerated precooked entrees, and hot dogs. Finally, the group did not want to impose too much on the goodwill of the experts who would be asked to give up more than an hour of their time to complete the questionnaire.

To solve this problem, the group outlined two product categories. Category A includes all raw or partially cooked meat or poultry products (such as breaded patties heated only long enough to fix the breading). Category B includes all fully cooked meat or poultry products. Only shelf-stable, dried, and fermented products were excluded. Some of the behaviors were applicable to both product

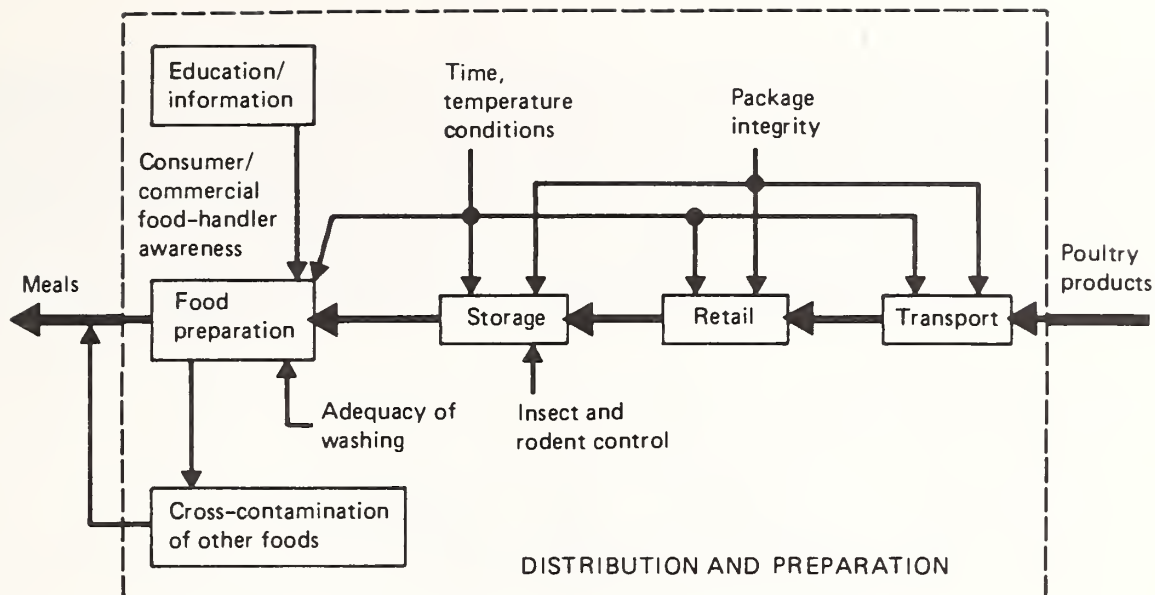


FIGURE 3-5 Distribution and preparation submodel.

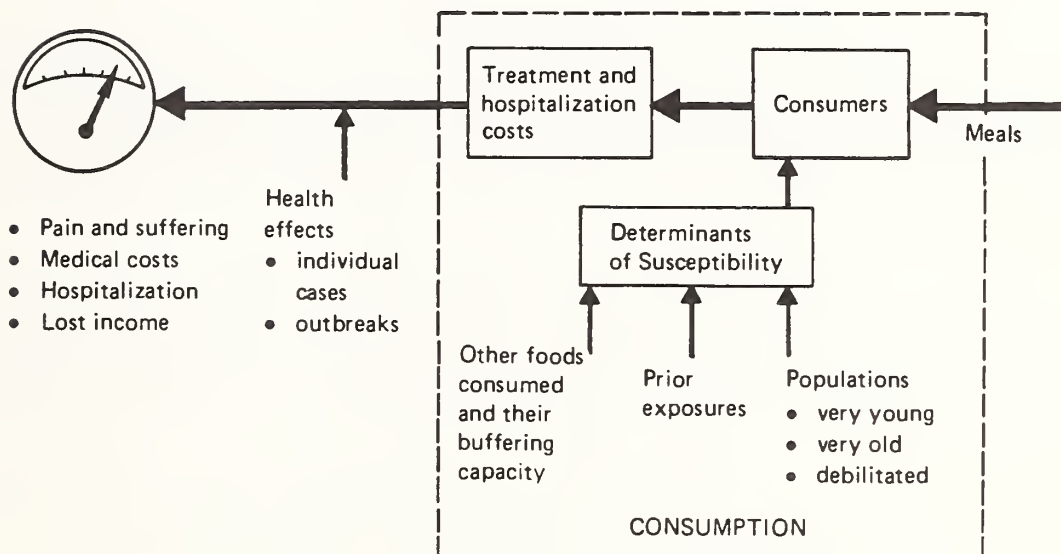


FIGURE 3-6 Consumption submodel.

Source: **Poultry Inspection; The Basis for a Risk-Management Approach.** Committee on Public Health Risk Assessment of Poultry Inspection Programs, National Research Council. National Academy Press, Washington, D.C. 1987.

categories. Others were applicable to only one product category; for example, only cooked products can be reheated.

One member of the working group next reviewed the Safe Food Book to be sure that every important piece of food safety advice was represented in the inventory of behaviors. A few new advice statements, developed since the Safe Food Book was published, were also included. Members of the core working group reviewed the inventory as a final check that all important advice had been included.

The final process inventory included 76 basic food handling behaviors grouped in five processes:

Acquisition	(3 control zones, 16 behaviors)
Home Storage	(3 control zones, 21 behaviors)
Initial Cooking	(2 control zones, 20 behaviors)
Serving	(3 control zones, 7 behaviors)
Handling Leftovers	(4 control zones, 12 behaviors)

HOW THE INFORMATION WAS COLLECTED

The working group sought the most objective measures possible of determining (1) the most important behaviors for home food handlers to follow in order to prevent foodborne illness, and (2) home food handler knowledge and practice of these behaviors.

Assessing risk

The group determined that both microbiological information (the conditions under which pathogens survive, reproduce, or, in some cases form toxin) and epidemiological information (the factors involved in actual outbreaks of foodborne illness) would be important in assessing the importance of specific handling behaviors.

Early on, the group decided that a literature search would not "prove" the importance of a specific handling behavior in preventing illness. Microbiologists on the working group pointed out that, although there are isolated exceptions, no great attention has been paid to researching specific measures for preventing microbial reproduction (or, in some cases toxin formation) in home food handling situations.

The working group did, nonetheless, conduct a literature search. The literature search helped update the background information files of ILA. It also confirmed that the HACCP approach has generally been applied in production and regulatory settings rather than the home food handling process.

Epidemiological information is priceless -- and limited. At the time the project began, there was no existing current analysis of errors involved in home outbreaks. The most recent available data was the 1982 Centers for Disease Control (CDC) report on foodborne disease surveillance (released in 1985) and an analysis by Dr. Frank Bryan, cited in one of the NAS reports, of the errors involved in meat and poultry-borne outbreaks between 1968 and 1977. Neither paper focused on home outbreaks.

Questionnaire approach. Because the literature lacked objective proof of the relative importance of various handling behaviors for meat and poultry in preventing foodborne illness, the Policy Analysis Unit suggested the approach of surveying credible experts.

This approach -- asking experts to predict outcomes and analyzing their responses for consensus -- is known as the Delphi technique. It has been extensively used in the public and private sector, and for many purposes, including education.

Policy Analysis Unit staff on the working group aided in designing the survey instrument, suggested appropriate criteria for selection of credible experts, conducted a pretest of four agency microbiologists, suggested improvements for the final questionnaire, and provided a computerized analysis of results. (See "How the Information was Synthesized.") Four groups of experts eventually completed the questionnaire or an adapted version. (For the basic questionnaire, see Appendix A.)

Risk of nonperformance. Three of the four groups were asked to rate the risk of not performing behaviors, using a 5-point scale, for the two product categories (raw or partially cooked, fully cooked). Risk was defined in microbiological terms; that is, "the risk of contamination levels high enough at the time of consumption to cause illness in a high-risk consumer if a behavior is not performed." 1 = no risk; 2 = small risk; 3 = moderate risk; 4 = high risk; 5 = very high risk; 9 = unable to rate risk.

High-risk consumers were defined as "those individuals who are more vulnerable to foodborne illness than are healthy adults. These include those with incompletely developed, suppressed or weakened immune systems: e.g., infants, children, pregnant women and their fetuses, AIDS or cancer patients or other seriously ill persons, the elderly, antibiotic users, the malnourished, and others. Such persons may not always be aware that they are at risk."

The questionnaire could have simply asked the food safety experts to identify and rank the behaviors most important in preventing foodborne illness. However, under the HACCP approach, the importance of a control point is determined largely by the consequences of not acting at the control point. The "critical control points" are those where failure to take corrective action is most likely to jeopardize the outcome of a process. In addition, the group believed that asking the experts to rate nonperformance would be more likely to produce reasoned judgments, as opposed to first reactions.

Because the experts would be asked to rate the risk of nonperformance for two separate product categories, each expert would actually make more than 120 distinct risk assessments.

The final questionnaire included several definitions and assumptions (see Appendix A). The "worst case" assumptions were designed to ensure that the risk of not performing each behavior was considered independently from all others, but consistently. The assumptions do not necessarily reflect reality. For example, as one commenter pointed out, it is simply not true that all processed

foods carry some contamination at the time of purchase. However, there are many opportunities for cross-contamination in the home food handling environment (or any food handling environment). If this occurs, cooked foods may well provide a better climate for microbial reproduction.

Finally, the questionnaire asked respondents for their views on care labeling and their views on the greatest microbiological food safety concerns over the next five years.

Survey of expert microbiologists. In late March 1988, the self-administered questionnaire was mailed, with a cover letter describing the study's purposes, to 13 highly experienced food microbiologists in the public and private sector. The criterion for "highly experienced" was at least five years experience working in food microbiology. The working group's microbiology subcommittee selected these 13 from a much larger list of experts in a variety of government, academic, and private organizations. Individual members of the subcommittee phoned the microbiologists to request their participation in the study. Participants were assured that their answers would be statistically tabulated, and that individuals would not be associated with specific answers.

Eleven of the microbiologists completed the questionnaire, usually without a follow-up call. In two instances, follow-up calls established that the questionnaire had been lost in the mail. Duplicates were mailed to the microbiologists and completed very quickly. In one instance, an expert simply could not find the time to complete the questionnaire. One completed questionnaire was excluded from consideration because the respondent also completed a questionnaire for the consumer knowledge/practice portion of the study. (Within the organization, the questionnaire was inadvertently forwarded to the same individual who had agreed to participate in the assessment of microbial risk.)

The questionnaire approach used in the study was highly effective. For each behavior, at least 8 of the 11 respondents to the survey of expert microbiologists were able to rate the risk of nonperformance using the 5-point scale. At least 10 of the respondents rated at least 90 percent of the behaviors.

Survey of epidemiologists. In late April, 1988, the same questionnaire was sent to three FSIS epidemiologists who agreed to participate. They were asked to assess risk in epidemiological rather than microbiological terms.

This survey was less successful. First, the sample size was very small. Second, the questionnaire was not formally revised to generate risk assessments in epidemiological terms, and inadequate time was spent explaining the rationale and purpose of the project. Third, the respondents did not complete their questionnaires in the same manner. For example, one rated the risk of nonperformance for control zones only. Finally, as one epidemiologist noted, there was little current epidemiological data available on which to base judgments. For these reasons, the questionnaire ratings were not used in the project. However, the working group considered and appreciated the comments of the epidemiologists.

Fortunately, current and accurate epidemiological data soon became available. In the the summer of 1988, Dr. Frank Bryan published an analysis of the "practices, procedures, and processes" that led to outbreaks in several different settings, including the home, 1973-1982. (He also used the same data to publish an analysis of food vehicles.) This objective information was used as the primary epidemiological data base. (See Table 6.)

Survey of members of National Advisory Committee on Microbiological Criteria for Foods. Finally, on October 25, 1988, the questionnaire was sent to the members of the National Advisory Committee on Microbiological Criteria for Foods. (See Appendix B.)

The Committee had expressed interest in the project, and earlier in October, Patricia Drayne, Deputy Director for FSIS-ILA, briefed the Committee on the project and described a few of the preliminary results. Several members of the Committee expressed interest in completing the questionnaire. Ten committee participants individually completed and returned the questionnaire.

Whereas the first group of experts surveyed had in common their background in food microbiology, the committee respondents reflected a diversity of expertise, including microbiology, epidemiology, food science, and regulation.

Obviously, the committee participants did not complete the survey instrument under the same conditions as the microbiologists. First, they had been briefed on preliminary results of the survey of expert microbiologists and thus their ratings could have been affected by that knowledge. Second, Dr. Frank Bryan's analysis of factors involved in home outbreaks of foodborne illness had also been published by this time, and many participants had read it; their responses could have been affected by that information.

Assessing home food handler knowledge/practice

The public awareness subcommittee chose three measures to assess food handler knowledge and practice. Ultimately, two of the three measures proved useful.

Survey of surveys. The Policy Analysis Unit conducted a literature search for published surveys having to do with consumer food handling. After extensive contacts with a number of libraries and searches of computerized databases, only five pertinent surveys could be located.

- 1973 Gallup Organization survey on knowledge of Salmonella and food poisoning.
- 1974 USDA/Economic Research Service survey, "Food Safety: Homemakers' Attitudes and Practices."
- 1983 survey, "Food Handling Practices," conducted by M. Woodburn, Department of Foods and Nutrition, Oregon State University.
- 1983 survey, "Kansas Food Safety survey," conducted by C. Kramer, Extension Home Economics, Kansas State University.
- 1987 "Trends" survey, Food Marketing Institute.

In all, these surveys directly addressed only 26 of the behaviors in the inventory. Preliminary results from an FDA survey supported in part by FSIS became available in early 1989. (For pertinent findings from all six surveys, see Appendix D. For discussion of current surveys, see Tables 1 and 2.)

Public awareness subcommittee members were subsequently asked to rate consumer knowledge and practice based on a consideration of all survey results over the 15-year period. However, the working group decided this joint rating was less useful than simply using the most recent adjusted survey data available.

Questionnaire approach. As in assessing risk, the working group decided to combine a literature search with a survey of experts.

However, this time, the experts were asked to rate consumer knowledge and practice of the food handling behaviors in the inventory. (See Appendix C for sample letter.) The experts were also asked for their views on care labeling and food safety education.

Nine experts were selected from a list of consumer experts known to have at least five years' experience in the field, and to represent a variety of organizations and viewpoints. They were, like the other respondents, assured that answers would not be associated with individuals. Seven of the nine selected experts completed the questionnaire.

The consumer experts used the same inventory of handling practices as the other respondents, except that a few practices in the inventory were broken into two parts. For example, "Use thermometer to verify 0 degrees F freezer temperature or colder" was broken into "Use thermometer to verify freezer temperature" and "Keep freezer at 0 degrees F or colder." The consumer experts were not asked to consider the two product categories separately, but they were asked to rate both knowledge and practice of home food handlers. Thus, they made more than 150 distinct assessments.

The experts were asked to use a 5-point scale, which was reversed for the final report: 1=Almost everyone knows/practices; 2= A large percent know/practice; 3= About half of home food handlers know/practice; 4= A small percent know/practice; 5= Almost no one knows/practices. Table 2 incorporates average knowledge/practice ratings.

The questionnaire approach was highly effective. For every behavior, at least 6 of the 7 respondents were able to rate consumer knowledge and practice, using the 5-point rating scale. The relatively small differences between raters on the items (1) indicate a high level of agreement among consumer experts on the extent of consumer knowledge and practice of important food handling behaviors, and (2) give greater credibility to the findings.

HOW THE INFORMATION WAS SYNTHESIZED

The recommendations for educational themes, the specific handling advice FSIS will use as the basis for its new consumer education publication, and Tables 1 through 9 are based on a synthesis of all information collected during the

course of the project on risk-based food safety education. This section describes how the information collected was analyzed and synthesized.

Synthesis consisted of assessing microbial risk and assessing home food handler knowledge and practice. Synthesis included analyzing and cross-referencing expert ratings, survey and epidemiological data, and expert comments, including comments on advice statement clarity as well as substance.

Determining appropriate themes for educational intervention is more than a matter of determining the risk of not performing a "safe food" practice. It is also important to assess home food handler knowledge in order to determine which of these important behaviors are least understood or practiced.

For example, undercooking is frequently a contributing factor to outbreaks of bacterial foodborne illness, and failure to cook foods thoroughly was rated as a moderately high to high risk by microbiology experts. Most consumers seem to have internalized the knowledge that thorough cooking of pork prevents trichinosis. (They may not realize that it also prevents salmonellosis, probably a more common microbiological contaminant than trichina on raw pork.)

However, 25 percent of Americans would serve undercooked (rare or pink) hamburgers, and another 44 percent never use a pop-up timer or meat thermometer for turkeys. This information underscores the need for more specific educational intervention on the undercooking theme.

Expert ratings. Each of the groups completing the microbial risk questionnaire had been asked to rate the risk of not performing a behavior using a 5-point scale: 1 = no risk; 2 = small degree of risk; 3 = moderate degree of risk; 4 = high degree of risk; 5 = very high degree of risk.

The consumer experts also used a 5-point scale to rate knowledge and practice of home food handlers. The scale was reversed for this report: 1 = Almost everyone knows/practices; 2 = A large percent know/practice; 3 = About half of home food handlers know/practice; 4 = A small percent know/practice; 5 = Almost no one knows/practices.

Table 2 includes all average ratings of risk and knowledge/practice. The initial computerized analysis of all sets of data included listings of ratings, in descending order; mean ratings above 4.0 (of highest concern) in descending order; ratings in descending order for each process; number of respondents, minimum, maximum, mean, and standard deviation for each food handling behavior; and frequency distributions and percentages of respondents rating each item in the inventory (for either microbial risk in the event of nonperformance, or for home food handler knowledge/practice).

The results of the computerized analysis were transferred by hand to blank questionnaires to allow for easier consideration and analysis by the project members. Because the sample sizes were quite small, measures such as standard deviation did not, by themselves, hold much meaning. However, the working group did find it useful to identify items whose nonperformance could not be rated by more than one person, those with a high standard deviation where the range of

answers was very broad, and those where comments indicated problems with question clarity.

Assessing risk

The working group sought to combine the risk perspectives of two expert microbiology groups with available epidemiologic information. One of the expert groups consisted solely of food microbiologists. The other, the National Advisory Committee on Microbiological Criteria for Food, includes microbiologists, epidemiologists and other food scientists.

Microbial risk. The microbiological subcommittee of the working group spent much time examining and discussing the results of the first survey of expert microbiologists. Survey respondents expressed slightly more concern about behaviors involving cooked foods than raw foods. When behaviors carrying out the same microbiological principle were grouped together, there was greatest concern among the expert microbiologists about (1) undercooking of raw food; (2) contamination of cooked food; and good practices with cooked food (good practices are those not classifiable in microbiological terms; for example, reporting problems to store management and local health authorities). Average scores are summarized below:

Average score	Microbiological principle	Number of behaviors
3.85	Cooking raw food	8 in Process 3
3.51	Avoiding contamination of cooked food	19 in all five processes
3.5	"Good practices"--cooked food	5 in Processes 1, 2, and 5
3.43	Time-temperature abuse of cooked food	35 in all five processes
3.30	Avoiding contamination of raw food	15 in Processes 2 and 3
3.25	"Good practices"--raw food	4 in Processes 1 and 2
3.16	Time-temperature abuse of raw foods	
3.0	Reheating cooked foods	

These averages were not surprising, nor by themselves, particularly meaningful. On average, failure to carry out the principles of safe food handling represents a moderately low to moderately high risk of enough "dinner-plate" contamination to cause illness. This confirms the importance of the basic principles.

There was a surprising amount of variation in expert ratings of microbial risk. For 33 behaviors, at least one expert microbiologist judged nonperformance to involve no microbial risk (1), and at least one expert microbiologist judged nonperformance to involve a very high microbial risk (5). Some of these differences, but by no means all, could be attributed to item clarity.

The ratings of the advisory committee participants served to prioritize risks in about the same way. However, they generally rated the risk lower than the group of expert microbiologists did. For example, the group of expert microbiologists might have assigned a rating of 4.9 to nonperformance of a specific behavior; the advisory committee participants might have rated it 3.9. There could be many reasons for the different ratings. One is probably that the first group

included only microbiologists; the second group included people representing additional food safety disciplines. Another is probably that the second group was privy to the preliminary results of the first group's rating at the time they completed questionnaire.

In any case, because of the wide variations, the working group found it useful to identify behaviors whose nonperformance was given average microbial risk ratings of 4.0 or above (high degree of risk if behavior not carried out) by both groups for either product category (raw or partially cooked; fully cooked). The expert panel of microbiologists gave average ratings of 4.0 or above to 19 behaviors; the members of the national advisory committee gave such ratings to 9 behaviors. Both groups agreed on average ratings of 4.0 or above for 7 behaviors. (See Tables 3, 4 and 5.)

The working group identified an additional 19 behaviors given average ratings of 3.6 or above (moderately high degree of risk if behavior is not carried out) by both groups for either product category. This information is not presented in a table, but can be extracted from Table 2.

Altogether, 27 behaviors were initially classified as "essential." If a color scheme were used in communication, these would be "red lights for food safety." In other words, do not proceed until you have carried out this step. Other analysts might have added more or fewer behaviors to the essential category; however, there was a natural break at 3.6 -- only 0.1 above the midpoint of the scale.

Next, the group identified several behaviors given average ratings of 3.0 or above by either group (moderate degree of risk if behavior is not carried out) for either product category. This group of behaviors was initially classified as "advised." (If a color scheme were used in communication, these would be "yellow lights for food safety.") The ratings of the advisory committee members tended to pull a few behaviors which would have otherwise been classified as "essential" into the "advised" category. This information is not presented in a separate table, but can be extracted from Table 2.

After these steps were taken, 14 behaviors were left which had been given average ratings between 1.8 and 2.9 -- no risk or small degree of risk if behavior is not carried out -- by one or both groups. Information on these "less important" behaviors is not presented on a separate table, but can be extracted from Table 2. In a few cases, the rating for a behavior in one control zone was not consistent with that for the same or similar behavior in another control zone. In such cases, the behavior was moved to the higher of the two risk categories.

The working group could have initially included this last group of behaviors in the "advised" category, or could have included some of the "advised" group in the "essential" category. However, the objective of the project was not to find more advice to provide home food handlers, but to assure that:

FSIS educational programs focus on providing the information that will most of the time protect most home food handlers from most preventable foodborne illnesses.

This initial breakdown was in any case on the conservative side, since respondents were initially asked to rate the microbial risk of enough contamination to cause illness in such vulnerable consumers as the elderly, children and the immunocompromised. A moderate risk for a more vulnerable individual might well constitute only a small risk for a less vulnerable consumer.

Epidemiological risk. Next, the considered epidemiological data -- primarily Dr. Frank Bryan's (1988) analysis of practices, procedures and processes involved in home outbreaks of foodborne illness between 1973 and 1982, and another 1988 Bryan article on food vehicles involved in foodborne illness outbreaks during the same period. (See Table 6.)

Arguably, the group could have considered epidemiological data first and would have reached the same conclusions. However, when the project began, little epidemiological data from the recent past was available.

Epidemiological data is invaluable in determining educational priorities. For example, Dr. Bryan found that two specific cooling errors have been very common contributing factors in foodborne outbreak over the last 20 years. One error is leaving cooked food at room temperature too long; the other is refrigerating foods in large, deep pots rather than shallow containers. Thus, this data undeniably outlines two specific behaviors for which educational intervention is needed.

Epidemiological data also has many limitations, as epidemiologists will be the first to note. Conclusions must be painstakingly pieced together from the evidence, and the evidence is not always as confirmable as epidemiologists would prefer.

For the purposes of this project, it would have been helpful to have more specific data on other behaviors, similar to that on cooling. For example, most homes -- and many restaurants and foodservice institutions -- use microwaves for cooking and reheating. Yet no one knows how often improper microwaving was a factor in undercooking that contributed to foodborne illness, because most investigational reports do not specify the cooking device.

The working group agreed with Bryan's characterization of "vital" vs. "trivial" factors. Thus, where Bryan's analysis showed that a food handling behavior actually contributed to at least 1 percent of home outbreaks, or where his analysis suggested that the risks of a factor are probably much greater than the evidence reflects, a behavior was upgraded from the "less important" or "advised" category to the "essential" category if it wasn't already in the latter category.

Next, the working group considered substantive comments made by the two groups who rated microbial risk, as well as the FSIS epidemiologists. In a few cases, these comments moved borderline "less important" or "advised" behaviors up to the next tier. (See Appendix E and Tables 8 and 9 for respondent comments.)

Finally, the working group clarified advice statements as much as possible. Advice statements were clarified, for example, if comments indicated the intent

of an advice statement was unclear, or if more than one respondent did not rate the risk of nonperformance or checked "9," indicating an inability (for any reason) to rate the risk of nonperformance. The microbiological subcommittee devoted several hours to clarifying advice statements. Finally, for clarity, some control zones were collapsed and logically related advice statements were combined. The list of advice statements that will be included in FSIS's new consumer education publication was drawn from this synthesis.

Assessing knowledge and practice of home food handlers

Next, the group incorporated information on the food safety knowledge and practice of home food handlers. (Obviously, epidemiological data also sheds light on what food handlers -- in any setting -- don't practice.)

Earlier, the group had chosen two methods to assess consumer knowledge and practice -- an extensive search for consumer surveys and a first-hand survey of consumer experts in government, education and private industry.

Surveys of home food handlers. Next to onsite observations of people handling food in their homes, consumer focus groups and surveys probably provide the most reliable measure of consumer knowledge and practice.

Initially, the working group found only a few recent surveys that addressed items relevant to the project. However, results from a 1988 FDA survey sponsored in part by FSIS became available in late 1988.

Some of the six surveys were national in scope; others were not. They involved different sample sizes and had different strengths and weaknesses. Policy Analysis Unit staff adjusted survey responses so that they all refer to the total sample (rather than a part of the sample, such as people who cook whole turkeys). Appendix D shows all adjusted results cross-referenced against the items in the behavioral inventory. Adjusted results, primarily from 1983-88, are shown in the last column of Table 2 and are described in Table 1.

The group arbitrarily decided that data older than 6 years was probably not current enough to be useful. (Nevertheless, a few interesting findings from the 1974 USDA study have been listed on Table 2.) Later, relevant preliminary findings from focus groups conducted by a private company were also provided to the group, and are referred to in Table 1.

Survey of consumer experts. The second method for assessing consumer knowledge and practice was a small survey of selected consumer experts in marketing, government, and educational environments. Each expert was asked to rate home food handlers' knowledge and practice of the food handling behaviors in the inventory. (See Appendix C for sample letter.)

The average ratings of consumer knowledge and practice are included in Table 2. This measure of knowledge and practice is not as objective as the working group would prefer. Nevertheless, it provides useful information. Interestingly, there was far more agreement among consumer experts on the degree of home food handler knowledge and practice than there was among scientists on the degree of microbial risk accompanying nonperformance of specific food handling behaviors.

In developing the narrative synthesis (Table 1) and the list of recommended themes for food safety education, the knowledge and practice results were considered in a very straightforward manner.

Survey results (adjusted) within the last 6 years were considered to be the primary measure of consumer knowledge or risk. Where survey results were present (the few), the views of consumer experts were only a secondary measure. (The views of consumer experts were not always consistent with survey results.)

Where survey results were lacking (many, many instances), the views of consumer experts were used as the primary measure of the food safety knowledge or practice of home food handlers. The working group also considered the comments of consumer experts (see Tables 8 and 9 and Appendix E), which often reinforced the importance of themes, as well as the importance of specific behaviors.

The Summary Report describes the major conclusions of the project and recommended themes and behaviors for food safety education. Table 1 describes, for the essential behaviors, the analysis that preceded the determination to rate the behaviors as essential. Table 2 presents the average numerical ratings of risk and knowledge/practice. Tables 3, 4, and 5 describe the the results of the surveys on microbial risk in more detail. Table 6 presents the epidemiological data used in arriving at risk assessments for each behavior. Table 7 describes expert views on the important food safety issues in the next five years. Table 8 describes expert views on care labeling. Table 9 describes the credentials of the experts. Several appendices are included (see Table of contents).

TABLE 1: RISKS, KNOWLEDGE, AND PRACTICE (Summary)

PROCESS 1: ACQUISITION

(Compresses control zones 1, 2, and 3 -- planning, buying, transporting food)

NOTE: In 1988 FDA survey, only 6 percent thought juices of raw meat and poultry were germ-free; 10 percent weren't sure. Most (83 percent) were aware that juices of raw meat and poultry are likely to carry germs.

***Keep packages of raw meat and poultry separate from other foods, particularly foods that will be eaten without further cooking.** For example, use plastic produce bags for fresh fruits and vegetables and consider using plastic bags to enclose individual packages of raw meat and poultry. Avoid placing raw meat and poultry in the cart in a manner that will allow fluids to drip on other foods.

This advice statement was revised after consideration by the microbiological subcommittee. The original statement in the inventory was: Use plastic bags, if available, to enclose individual packages of raw meat and poultry. In Process 1, neither expert group rated failure to overwrap raw meat and poultry as a high risk. However, in Process 2, both expert groups rated as a high risk failure to perform a similar behavior -- using plastic bags or aluminum foil to overwrap individual packages of raw meat or poultry before refrigeration. No specific epidemiological data, but keeping products separate prevents cross-contamination. No survey data, but consumer experts believe (for both process 1 and 2) that fewer than half of consumers know or practice overwrapping raw meat and poultry.

The statement was rephrased to stress product separation and to include specific examples because: a) not all stores provide plastic bags; and (b) some consumers prefer not to use plastic bags. If raw products are isolated in the cart from other foods that will be eaten without further cooking, and if individual packages (for use within 1 to 2 days) are placed on plates in the refrigerator, this will avoid cross-contamination as well as using plastic overwraps.

***Buy products labeled "keep refrigerated" only if they are stored in a refrigerated meat case.**

Both expert groups rated failure to perform this behavior as a very high risk. No specific epidemiological data available, but inadequate cooling is the most common food handling error. It was a factor in 22 percent of foodborne outbreaks (not just those involving meat and poultry). No consumer survey data available. Consumer experts believe well over half of consumers know and practice this behavior. No specific data available on how often "keep refrigerated" foods are not stored properly in retail stores; assumed to be small. However, preliminary results of a proprietary study of 4 focus groups of consumers (in connection with development of time-temperature monitors) found that consumers sometimes observed retailers leaving refrigerated foods in aisles for long periods of time, and that consumers sometimes also leave unwanted refrigerated foods in dry goods section.

TABLE 1, continued

PROCESS 1: ACQUISITION, continued

***Buy unpackaged meat or poultry from deli refrigerated cases only if not in contact with other foods.** For example, USDA does not advise purchase of fresh prestuffed whole poultry. USDA recommends purchase of fully cooked prestuffed whole poultry only if it will be served within 2 hours after purchase.

(Statement slightly revised.) Both expert groups rated failure to perform this behavior as a very high risk. No specific epidemiological data available, no consumer survey available. Consumer experts believe only a small percentage of consumers know or practice this behavior. (For prestuffing, see also Process 3, preliminaries.)

***Buy packaged precooked foods only if packaging is sound; for example, no tears in packaging.**

(Statement slightly revised.) Both groups of experts rated failure to perform this behavior as a moderately high to high risk for cooked foods, and a much lesser risk for other foods. Comments and discussion suggest that the risk is greatest for precooked refrigerated or frozen entrees. No epidemiological data. Survey data show that only 2 percent of consumers don't check food packaging. This may be related to tampering more than food safety concerns. Consumer experts also believe that very few consumers fail to check food packaging. Thus, while failure to perform this behavior is a high risk, most people appear to carry out the behavior.

***Shop for meat and poultry last. Within 2 hours, serve, reheat, refrigerate or freeze cooked foods -- within 1 hour if it's hot out.**

(Compresses three behaviors). Both expert groups ranked failure to perform the behaviors as a high risk (higher for cooked foods). No specific epidemiological data. No survey data, but consumer experts believe fewer than half of consumers know or practice safe transport of hot food.

***Report problems with packaging, product, storage, sanitation to store management. If still unsatisfied, report to local health authorities.**

The experts disagreed on the importance of this behavior. One group rated nonperformance as a moderate to high risk, and the other group rated nonperformance as a small to moderate risk. There were several comments on this item. Several commenters stated that reporting is not always effective in correcting a problem. Others rightly pointed out that reporting is not related to microbiological safety or immediate individual protection. Reporting is a "good Samaritan" practice that protects others in the future and enlightens a product manufacturer or retailer about a problem. Despite the mixed average risk ratings, a large number of experts rated nonperformance as very important. No epidemiological data available, although it is possible that one person's failure to report a problem could have allowed others to become ill. No consumer survey data available. Consumer experts believe fewer than half of

TABLE 1, continued

PROCESS 1: ACQUISITION, continued

consumers know to report problems, and that even fewer actually do so. Consumer experts commented that many consumers simply do not know how to go about reporting a problem with a product or its storage. Despite the borderline risk rating, this behavior was included in the final list of essential behaviors because of the high frequency of respondents who believe it is important and because of the intensity of the comments.

#Plan ahead to make sure you have enough refrigerator or freezer space for your meat and poultry purchases.

#Buy foods from reputable source with no known record of unsafe handling.

#Buy frozen products only if they appear frozen to the touch.

#Buy open-dated products only if label sell-by, use-by or pull-by date has not expired.

#Pack raw foods in an ice chest if time from store to home refrigerator will be more than 1 hour.

PROCESS 2: HOME STORAGE

Control Zone: Refrigeration (In 1974, 22 percent of consumers believed refrigeration stops bacterial growth; no current info available.)

***Keep raw meat or poultry separate from other foods, particularly those that will be eaten without further cooking. Use plastic bags or aluminum foil over commercial packaging on meat or poultry -- or place product on plate -- to prevent raw juices from dripping on other foods or refrigerator surfaces.**

(see Process 1, above)

***Refrigerate products with "keep refrigerated" labels.**

Both groups rated risk of nonperformance quite high. No specific epidemiological data available, although inadequate refrigeration is the most common error in foodborne outbreaks. No survey data available. Consumer experts believe a very large percentage of consumers know and practice this behavior.

***If refrigerator fails, keep door closed and, within a few hours cook products or place in environment 40 degrees F or colder.** Because refrigerator and climate conditions may vary a great deal, call the Tollfree Meat and Poultry Hotline for specific advice on your situation.

Both groups rated risk of nonperformance very high. No epidemiological data available, but inadequate refrigeration contributes to 22 percent of home outbreaks. Consumer experts believe about half of consumers know and practice this behavior. Survey data for other questions show this is a knowledge and

***essential #advised**

TABLE 1, continued

PROCESS 2: HOME STORAGE, continued

Control Zone: Refrigeration, continued

practice problem. Although no experts questioned the 6-hour time limit posed in the original advice statement, FSIS is not satisfied that this is a time limit general enough to suit all climates or situations. Consequently, ILA is still studying this issue.

#Use refrigerator thermometer to verify temperatures of 40 Degrees F or colder.

#Maintain a clean refrigerator.

#Wash hands with soap and water for 20 seconds before rewrapping products whose packaging was damaged during transport.

#Use undated products within a safe time limit that will also assure quality. Dating undated products at home is a good idea.

Control Zone: Freezing (In 1974, 20 percent believed freezing would kill bacteria; no current information available.)

***If freezer fails, keep door closed. Within 1 to 2 days, refreeze meat and poultry with crystals. If freezer compartment fails, keep door closed and find another cold source within a few hours, OR cook and serve the product.**

Because freezer and climate conditions can vary a great deal, call the Tollfree Meat and Poultry Hotline for specific advice if this happens to you.

Both groups rated risk of nonperformance high to very high. No specific epidemiological data available, but inadequate refrigeration is major problem in outbreaks. FDA 1988 data show 12 percent would cook meat defrosted over the weekend and warmer than refrigerator temp; 6% would test; 2% would refreeze; 3% would give to pet.

#Freeze foods with a "keep frozen" label.

#Use freezer wrap, freezer-quality plastic bags, or aluminum foil over commercial wrap on products for the freezer.

#Wash hands with soap and water for 20 seconds before rewrapping product whose packaging was damaged in transit.

PROCESS 3: PREPARATION

Control Zone: Preliminaries

***Wash hands (gloved or not) with soap and water for 20 seconds before beginning preparation, after handling raw meat or poultry, after touching animals, using bathroom or changing diapers.**

Handwashing is a traditional emphasized food safety measure, and evidence indicates a fingernail brush probably is more effective in removing bacteria. Handwashing is more important at some points of the food handling process than others. For Process 3, both groups rated risk of nonperformance quite high. In

*essential #advised

TABLE 1, continued

PROCESS 3: PREPARATION, continued

Control Zone: Preliminaries, continued

about 10 percent of outbreaks, a factor is food handling by colonized person (Bryan suggests may be victim or carrier). 1988 FDA data show 24 percent of consumers would merely rinse or wipe hands; 2 percent would simply continue cooking; 73 percent would wash with soap. (In 1974, 94 percent did not know that washing minimizes the spread of bacteria.) Consumer experts believe that most people know about handwashing but that fewer than half practice it.

***Don't let juices from raw meat or poultry come in contact with any other food, raw or cooked. Wash your hands, counters, equipment, and utensils with soap and water immediately after use.** (Examples: Acrylic cutting boards are easier than wooden cutting boards to keep clean; don't reuse marinades.)

A rather confusing advice statement from cooking control zone has been compressed with one from this zone. Sanitation prevents cross-contamination. Both groups rated risk of nonperformance for both advice statements as high. The two specific examples were added because (a) research has established that wooden cutting boards are difficult to keep clean; and (b) calls to the Meat and Poultry Hotline suggest that reuse of marinade is commonly practiced. Inadequate cleaning of equipment contributed to only one home outbreak, and cross-contamination contributed to 3.2 percent of outbreaks. However, Bryan and others believe that home food handling offers many opportunities for cross-contamination. After the fact, it is not always easy to establish that cross-contamination occurred. 1988 FDA data show that, after cutting raw meat or poultry with a knife, 25 percent would use the knife as is or merely rinse or wipe it; and 29 percent would use the cutting board as is, rinse or wipe it. Same data show 6 percent think juices are germ-free; 16 percent aren't sure. (Most people are aware that juices of raw meat and poultry often carry bacteria.

***Thaw only in refrigerator, under cold water changed every 30 minutes, or in microwave (followed by immediate cooking).**

Both expert groups rated this as a moderate to high risk. Thawing has not been a factor in known outbreaks, but Bryan believes risk of illness may be high from improper thawing of cooked foods, or from incomplete thawing of turkeys and other large raw pieces (followed by undercooking). 1983 Oregon survey shows 27 percent would thaw turkey at room temperature. Consumer experts believe about half of consumers know not to thaw at room temperature, but that well over half actually do thaw at room temperature.

***Stuff raw product immediately before cooking.**

Both groups of experts rated risk of nonperformance quite high. No epidemiological data. Consumer experts believe about half of consumers know and practice this behavior. (In 1974, 11 percent did not know to stuff turkeys just before roasting; 2 percent did ahead.)

*essential #advised

TABLE 1, continued

PROCESS 3: PREPARATION, continued

Control Zone: Preliminaries, continued

***Don't taste meat or poultry when it's raw or during cooking.** (Could apply to eggs, fish and shellfish -- any raw food of animal origin.)

Two advice statements (one from preliminaries and one from cooking control zone) have been compressed. In both zones, both groups of experts rated risk of nonperformance very high. Tasting raw or undercooked foods is a common factor in parasitic outbreaks, but no specific epidemiological data showing its involvement in bacterial outbreaks. No survey data. Consumer experts believe more than half of consumers taste raw or undercooked meat or poultry.

#Sneeze away from food.

#Marinate raw products in the refrigerator.

#Wear clean plastic glove over skin cut, particularly when handling cooked products.

Control Zone: Initial Cooking or Reheating by Consumer [Note: This zone includes both cooking of raw products and reheating of processed products. Some might place the function of reheating processed products under Process 5.]

(Cooking raw products)

***Use meat thermometer to judge safe internal temperature of meat and poultry over 2 inches thick (160 degrees F or higher for meat, 180 degrees F or higher for poultry). If your microwave has a temperature probe, use it.** In conventional cooking, particularly for consumers without meat thermometers, USDA advises oven temperatures of 325 degrees F or above. For microwaving, USDA advises consumers to cover raw meat and poultry, to let cooked food stand for recommended time and to check temperature of microwaved meat and poultry in at least three spots. [Several advice statements compressed]

Thermometer use. Both expert groups rated risk of nonperformance high. Undercooking was a factor in more than 30 percent of all home outbreaks, and a properly used thermometer is the surest way to know when large cuts are cooked. (A temperature of 160 degrees F should provide a margin of safety for either meat or poultry; however, few consumers would find poultry at that temperature to be palatable.) However, 1988 FDA data shows that 44 percent of consumers NEVER use a meat thermometer or pop-up timer when they cook whole turkeys (3 percent sometimes use). Only 14 percent use a meat thermometer as a major cue for doneness of roast beef. In addition, 11 percent would cook a whole turkey at less than 325 degrees F for part or all of the cooking time. Consumer experts believe about half of consumers know about and use meat thermometers. Meat and Poultry Hotline home economists advise temperatures of 325 degrees F or above, particularly for consumers without thermometers, because of the difficulty of assuring thorough oven cooking at very low temperatures over extended periods.

TABLE 1, continued

PROCESS 3: PREPARATION, continued

Control Zone: Initial Cooking or Reheating by Consumer, continued

Such cooking, as advised in a newspaper recipe, was the factor that caused a fatal salmonellosis outbreak in the 1970's.

Use of microwave temperature probe. Both groups of experts believed that nonuse of microwave probe is a small to moderate risk, and that the risk of nonperformance is higher when cooking raw products. (Several microbiologists advised against using microwaves for raw meat and poultry, presumably because of "cold spots.") Absolutely no epidemiological data available on involvement of microwaving in foodborne illness. No consumer survey data, but consumer experts believe few people use probes even when they come with the appliance. Meat and Poultry Hotline home economists advise covering raw meat and poultry, letting cooked product stand and checking doneness in three spots to increase likelihood of even microwave cooking.

***For meat or poultry less than two inches thick, look for clear juices and lack of pink in the center as signs of "doneness."** [statement revised]

(The statement originally referred to use of recipes and did not specify color interior of meat should be.) This advice statement is more useful for raw than cooked products. Both groups of experts rated risk of nonperformance quite high. Undercooking is a factor in about 30 percent of outbreaks. A 1988 outbreak that hospitalized 6 Minnesota children was attributed to incompletely processed precooked hamburgers that were then thawed at room temperature for several hours and inadequately reheated. A 1988 FDA survey found that 25 percent would serve undercooked hamburgers -- rare, medium rare or pink in the middle. Recipes can give unsafe advice, and the Meat and Poultry Hotline encourages consumers to call its tollfree number if they have questions about a recipe's safety.

***Use Crockpots, ^Psmokers, or slow cookers according to label directions.** USDA advises consumers to start with fresh, not frozen chunks of meat and vegetables, and to be sure the recipe includes a liquid. Using a thermometer in three spots is the best way to assure that casseroles are thoroughly cooked to 160 degrees F.

Both groups of experts rated risk of nonperformance quite high. (Experts rated risk of reheating in these devices as moderate to high, and hotline recommends against using these devices for reheating.) Hotline discourages cooking large cuts in these devices. No specific epidemiological data about involvement of these devices in foodborne illness, but undercooking is a factor in about 30 percent of outbreaks. No survey information is available. Consumer experts believe that well over half of consumers know about and follow label directions for these devices. Consumer experts have raised questions about the accuracy of labeling instructions on these devices.

TABLE 1, continued

PROCESS 3: PREPARATION, continued

Control Zone: Initial Cooking or Reheating by Consumer, continued

***Avoid interrupted cooking.** USDA advises against recipes that call for "cooking without a heat source." For example, boiling water, inserting poultry, turning off water; preheating oven to 500 degrees F, inserting roast, turning off oven.

Both groups rated risk of interrupted cooking moderate to moderately high. No specific epidemiological data pertaining to interrupted cooking; however, undercooking is a factor in about 30 percent of home outbreaks, and lapse of 12 or more hours between cooking or eating is a factor in 12.8 percent of home outbreaks. Therefore, this behavior was moved from "advised" to "essential" category. No recent survey data. Consumer experts believe about half of consumers practice interrupted cooking. Trendy recipes occasionally call for partial cooking, followed by refrigeration and completion of cooking. Meat and Poultry Hotline home economists report frequent calls about recipes that call for "cooking" without a heat source.

(Both cooking raw products and reheating processed products)

***Based on microwave cooking instructions on label, increase microwave time if necessary for product to reach safe internal temperature.**

This is a very difficult issue, since both microwaves and cooking instructions on microwaveable products may vary a great deal. Better advice statement may need to be formulated. Both groups of experts rated nonperformance as a quite high risk, particularly for raw products. No specific epidemiological data is available on the involvement of improper microwaving in outbreaks, but undercooking is a factor in about 30 percent of home outbreaks and under-reheating is a factor in about 3.5 percent of home outbreaks. Bryan suggests that risks may actually be greater when products are inadequately reheated than when they are undercooked in the first place. More organisms of concern will be on foods subjected to time-temperature abuse than would be present on raw foods. No survey data available. Consumer experts believe fewer than half of consumers know or practice this behavior.

***Use rotating microwave pad or rotate foods manually during microwaving.**

Both groups of experts believe the risk of nonperformance is moderate. No epidemiological data is available on the involvement of inadequate microwaving in outbreaks, but undercooking is a factor in about 30 percent of home outbreaks and under-reheating is a factor in about 3.5 percent of home outbreaks. Bryan suggests risks of inadequate reheating may be greater than the risks of inadequate cooking. (See 'increase microwave cooking time', above.) No survey data available. Even though microwave manufacturers routinely advise rotation, consumer experts believe few consumers rotate foods

TABLE 1, continued

PROCESS 3: PREPARATION, continued

Control Zone: Initial Cooking or Reheating by Consumer, continued

during cooking. Therefore, to be on the safe side, this advice statement was included in the final list of essential handling measures.

***Particularly when using the microwave for cooking raw meat or poultry, let microwaved food stand for recommended number of minutes before serving.**

(Statement slightly revised.) This borderline advice statement was moved from "advised" to "essential" category after discussion. Standing time completes the cooking process. Both groups of experts rated standing time as of little importance except when cooking raw meat or poultry in the microwave. (Several microbiologists commented that microwave cooking of raw meat or poultry is unsafe.) No epidemiological information. No survey information. Consumer experts believe more than half of consumers know and practice this behavior.

PROCESS 4: SERVING

Control Zone: Room temperature holding Improper cooling -- holding foods at room/outside temperature too long, refrigerating foods in large, deep containers -- was the most important contributory factor to all outbreaks over all periods of review; improper cooling contributed to 22.3 percent of home outbreaks. Lapse of 12 or more hours between cooking and serving (time-temperature abuse also assumed) contributed to 12.8 percent of outbreaks.

***Serve cooked products on clean plates and with clean utensils and clean hands. Wash hands with soap and water before serving or eating food.** For example, never put barbecued chicken back on the platter that held raw chicken.

Both groups rated nonperformance of the first behavior (serve on clean plates...) as a high risk. Throughout the food handling process, nonperformance of handwashing was generally rated as a moderate to moderately high risk. A colonized person [Bryan notes might be carrier or victim] handling implicated food was a factor that contributed to 9.9 percent of home outbreaks. Improper cleaning of equipment or utensils contributed to only 1 outbreak. No survey information available, but consumer experts believe fewer than half of consumers wash hands, and more than half serve cooked food on clean plates...

***In environmental temperatures 90 degrees F or above, leave out cooked food no longer than 1 hour before reheating OR refrigerating or freezing.**

Both groups rated risk of nonperformance very high. Although specific involvement of holding at temperatures of 90 degrees F or above isn't quantified in epidemiological data, holding food at room/outside temperature and/or refrigerating foods in large, deep containers contributed to 22.3 percent of home outbreaks. Improper cooling -- including holding at room temperature too long -- most important contributory factor in all periods of review. No survey data available. Consumer experts believe about half of consumers know to refrigerate food within one hour after cooking in summertime temperatures, but that fewer than half of consumers actually do this.

*essential #advised

TABLE 1, continued

PROCESS 4: SERVING, continued

Control Zone: Room Temperature Holding, continued

***In environmental temperatures below 90 degrees F, leave out cooked food no longer than 2 hours before reheating OR refrigerating or freezing.**

Both groups rated risk of nonperformance as a moderate to high risk. As indicated above, epidemiological data shows improper room temperature holding to be a major factor in outbreaks. 1988 FDA data showed that 75 percent said they would cool foods to room temperature, but only 14 percent said they might leave out more than 2 hours. Consumer experts believe about half know the importance of the 2-hour rule, but that fewer than half actually follow it.

Control Zone: Hot Holding

***Hold hot food above 140 degrees Fahrenheit.**

Both groups of experts rated the risk of nonperformance as high to very high. Interestingly, this was one behavior the advisory committee found more important than did the committee of expert microbiologists. Improper hot holding, at bacterial incubation temperatures, was a factor in about 3.2 percent of home outbreaks. No consumer survey data available. Consumer experts believe that fewer than half of consumers know the importance of hot holding, and that even fewer actually practice hot holding. One expert raised the question, "How long?"

Although experts have no difficulty distinguishing between hot holding and room temperature holding, consumers might. One expert commented on the inadequacy of warming devices to keep foods hot enough. It seems that it may be safer to serve foods at room temperature (and refrigerate within 2 hours in moderate temperatures) than to attempt to keep foods only warm, rather than hot. This deserves more thought and discussion.

Control Zone: Eating

#Avoid dipping personal spoon in serving dish.

PROCESS 5: HANDLING LEFTOVERS

Use of leftovers was a factor in 2.6 percent of home outbreaks. Lapse of 12 or more hours between cooking and eating was a factor in 12.8 percent of home outbreaks.

Control Zone: Cold Storage (Sanitation and Cold Storage compressed in one zone)

***Wash hands before handling leftovers and use clean utensils and surfaces.**
(Already discussed.)

*essential #advised

TABLE 1, continued

PROCESS 5: HANDLING LEFTOVERS, continued

Control Zone: Cold Storage, continued

***Remove stuffing before cooling or freezing.**

Both groups of experts rated nonperformance as a moderately high to very high risk. No specific epidemiological data. No current survey data. In 1974, 32 percent believed it was safe to leave stuffing in turkey in the refrigerator; 3 percent said they did so. Consumer experts believe that fewer than half of consumers know it is important to remove stuffing before refrigerating products, and that a slightly higher percentage actually do remove stuffing.

***Refrigerate or freeze cooked leftovers in small, covered, SHALLOW containers within 2 hours after cooking. Leave airspace around containers to help assure rapid, even cooling.** Home economists with the Tollfree Meat and Poultry Hotline suggest using containers 3 inches deep or less (for example, cake pans).

Whether foods are considered "served" or "leftovers," after time elapses the risk of illness begins. (The comments show that some experts believe the "2-hour rule" is too liberal, and others believe it is too conservative.) Failing to refrigerate cooked foods promptly in proper containers is probably the most significant of the food handling errors. Both groups of experts rated nonperformance as a very high risk.

Cooling errors (leaving foods at room or outside temperature too long, refrigerating in large, deep containers) constitute the most important contributory factor in all periods of review; cooling errors were a factor in 22.3 percent of home outbreaks. 1988 FDA survey data show that 67 percent would leave food in cooking pot or in one large container for refrigeration; 14 percent might leave at room temperature more than 2 hours (75 percent would cool food to room temperature before refrigerating). Consumer experts believe that less than half of consumers know the importance of using shallow containers or refrigerating foods promptly after cooking, and that even fewer do it.

The expert groups did not agree on the importance of leaving air space around containers. It was moved from the "advised" to the "essential" category after discussion. One group rated nonperformance as a small risk; the other group rated it as a moderately high risk; consequently, it was included in the list of essential behaviors to assure rapid and even cooling. Epidemiological data suggests that this is a real problem in institutional kitchens. No survey data exists, but consumer experts believe only a few consumers know or practice this behavior.

***Avoid tasting old leftovers to determine safety.**

The risk of tasting leftovers was judged moderate to moderately high (and there is no epidemiologic information on how much tasting of leftovers

TABLE 1, continued

PROCESS 5: HANDLING LEFTOVERS, continued

Control Zone: Cold Storage, continued

contributes to illness). Some information suggests this is a common practice. A 1988 FDA survey found that 9 percent thought food could not be spoiled if it looked or smelled OK; and 6 percent weren't sure. Based on a 1983 survey, 45 percent would finger or taste to determine safety. Consumer experts believe well over half of consumers probably taste foods to determine safety. Accordingly, this suggestion was moved from "advised" to "essential" category.

#Date leftovers to allow use within safe time period.

Control Zone: Reheating Cooked Leftovers

***Cover and reheat leftovers to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, "wet" foods; 165 degrees F for all others).**

Both groups of experts rated nonperformance as a high or very high risk. Inadequate reheating was a factor in 3.5 percent of home outbreaks. However, Bryan notes that risks may be greater than that of improper cooking, because [he believes] chilled foods are frequently merely warmed up rather than thoroughly reheated. More organisms of concern will be on foods subjected to time-temperature abuse than would be present on raw foods. 1988 FDA data show that about 21% of consumers would reheat leftovers containing meat or chicken till bubbling; 8 percent would use a thermometer or microwave probe to determine doneness. Consumer experts believe that far fewer than half of consumers know the importance of thorough reheating, and that only a small percentage actually reheat foods thoroughly.

Control Zone: Disposal of Leftovers

***If in doubt, throw it out. Discard outdated, unsafe or possibly unsafe leftovers in garbage disposal or in tightly wrapped packages that cannot be consumed by people or animals.**

Groups were asked to rate the risk of nonperformance in two different processes (Process 2 and Process 5). Both groups rated nonperformance as a moderately high risk. Leftovers are a factor in 2.6 percent of home outbreaks. 1988 FDA data shows that 9 percent of consumers thought food could not be spoiled if it looks or tastes O.K.; 6 percent weren't sure. (Most knew it could look or smell fine, yet be unsafe.) Three percent would feed questionable food to pets. No survey information available on extent of consumer knowledge about safe disposal, but consumer experts believe only a small percentage of consumers practice safe disposal of leftovers.

TABLE 2
RISKS, KNOWLEDGE AND PRACTICE (NUMERIC RATINGS)

	1 Raw/ Cooked	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 1: ACQUISITION				
E:(Raw meat, poultry and other foods of animal origin frequently contaminated with Salmonella, Campylobacter, other bacteria)			4/FDA, 1988: 6% thought juices of raw meat & poultry were germ-free; 10% weren't sure	

Control Zone 1 - Planning Food Acquisition

a-1. Plan use of food before purchase.	2.2 [1.8]	2.3 2.0]	2.1	2.6
a-2. Plan to buy from reputable # source with no record of unsafe handling.	3.2 [2.0]	3.9 2.6]	2.0	2.7
a-3. Check to see that home # refrigerator/freezer storage is adequate for items to be purchased.	3.8 [2.4]	3.9 3.0]	3.0	3.3
a-4. Consider outside temperature # in planning trip.	3.0 [2.6]	2.9 3.2]	3.6	4.0
a-5. Plan to shop for food last. *	3.7 [3.2]	4.0 3.6]	2.5	2.7
E:(Improper cooling,thawing)				

Control Zone 2 - Obtaining Food

a-6. Buy packaged meat and poultry * only if packaging is sound (examples: undented cans, refrigerated/frozen products without tears in packaging).	3.5 [2.7]	4.1 3.4]	1.7	2.3	4/1987: 2% don't check packaging
a-7. Buy products labeled "keep * refrigerated" only if they are stored in a refrigerated meat case. E: (Improper cooling)	4.7 [3.8]	4.9 4.5]	2.4	2.9	
a-8. Buy frozen products only if # they appear frozen solid to the touch.	3.9 [3.3]	4.2 3.4]	2.4	2.3	

*Essential (Based on expert risk rating and epidemiological information)

#Advised

E:Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-1982. Not necessarily direct relationship with this behavior.

- 1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets]
- 2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets]
- 3 Consumer expert average rating for knowledge or practice of behavior.
- 4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.

TABLE 2, continued

	1 Raw/	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 1: ACQUISITION, continued				
Control Zone 2 - Obtaining Food, continued				
a-9. Buy products from deli	3.6	4.5	4.0	4.3
* refrigerated display cases only	[2.8	3.8]		
if unpackaged products are not in contact with other unpackaged raw or cooked products.				
E: (cross-contamination of cooked foods or foods eaten without cooking)				
a-10. Buy "open dated products only	3.5	3.9	2.3	2.2
# if label sell-by, use-by, or pull-by date has not expired.	[2.7	3.4]		4/1987: 7% don't check.
a-11. Place meat, poultry, cold foods in shopping cart last.	2.7	2.9	3.4	3.7
	[2.2	2.6]		
a-12. Place packages of raw meat and poultry in individual plastic bags, if available.	2.6	NOT RATED	3.3	3.3
* (See b-1)	[2.3]			
E: (cross-contamination)				
a-13. Report problems with packaging product, storage, sanitation to store management. If still unsatisfied, report to local health authorities.	2.5	2.7	3.2	4.0
* [3.0	3.4]			

Control Zone 3: Transporting Meat and Poultry

a-14 Pack raw or partially cooked	3.3	3.4	3.5	4.3
# foods in an ice chest if	2.7			
time from store to home will	[2.9	3.3]		
be 1 hr. or more. [advice	2.9			
statement revised]				

*Essential (Based on expert risk rating and epidemiological information)

#Advised

E: Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.

- 1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets].
- 2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets].
- 3 Consumer expert average rating for knowledge or practice of behavior.
- 4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.

Table 2-2

TABLE 2, continued

	1	2	3(Expert)	4(Survey)
	Raw/	Cooked	Knowl/Prac	
PROCESS 1: ACQUISITION, continued				
Control Zone 3: Transporting Meat and poultry, continued				
a-15. Hold hot foods above 140 degrees	NOT	3.8	3.2	3.5
* F in vehicle, OR plan to reheat	RATED [3.8]			
or place in cold storage within				
2 hours.				
E:(Improper hot holding,improper cooling of cooked foods)				
PROCESS 2: HOME STORAGE OF MEAT AND POULTRY				
			4/1983,Ka: Consumers ranked home	
			#8, last, as place where food	
			safety concerns occur.	
			4/1974:22% believed refrigeration	
			stops bacterial growth.	
Control Zone 4: Refrigeration				
b-1. Use plastic bags, aluminum	4.1	NOT	3.1	3.7
* foil over commercial packaging	[3.9]	RATED		
or place product on plate to	See a-12			
prevent raw juices from dripping				
on other foods or refrigerator				
surfaces.				
E:(cross-contamination of cooked foods or foods that will be eaten w/o cook)				
b-2. Wash hands with soap and water	3.2	3.4	4.3	4.3
# for 20 seconds before rewrapping	[2.5	2.6]		
product whose packaging was damaged				
during acquisition or transport.				
E: (colonized person or victim contaminating food)				
b-3. Use refrigerator thermometer to	3.3	3.5	3.3	4.3
# verify temperature of 40 degrees	[2.8	3.3]		
Fahrenheit or colder.				4/1974: 49%
E: (Improper cooling of cooked foods)				had fridges
				warmer than
				40 degrees.
b-4. Refrigerate products with "keep	4.5	4.8	1.7	1.7
* refrigerated" label.	[4.1	4.7]		
E: (Improper cooling of cooked foods)				
*Essential (Based on expert risk rating and epidemiological information)				
#Advised				
E: Failure in parentheses contributed to home outbreaks of foodborne illness,				
1973-82. Not necessarily direct relationship with this behavior.				

- 1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets.]
- 2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets.]
- 3 Consumer expert average rating for knowledge or practice of behavior.
- 4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.

TABLE 2, continued

	1	2	3(Expert)	4(Survey)
	Raw/	Cooked	Knowl/Prac	
PROCESS 2: HOME STORAGE OF MEAT AND POULTRY, continued				
Control Zone 4: Refrigeration, continued				
b-5. Store meat and poultry in back of refrigerator rather than in door.	2.7 [2.5]	2.9 [2.8]	2.9	3.0
b-6. Maintain a clean refrigerator.	2.7 [2.2]	3.1 [2.6]	2.0	3.0
#				
b-7. Refrigerate raw meat and poultry within 1 hour after removing from meat case.(SEE a-5, a-14)	3.3 [2.7]	NOT RATED	2.9	3.3
#				
b-8. Date undated products so they can be used within a safe time limit that will also assure quality (see Appendix for Safe Food Book, p. 14 chart on Cold Storage).	3.2 [2.3]	3.3 [3.3]	3.0	4.2
#				
b-9. Use dated or undated products within a safe time limit that will also assure quality.	3.5 [2.6]	3.6 [3.1]	2.7	3.5
#				
b-10. If refrigerator fails, keep door closed and, within 6 hours, cook products OR place in environment 40 degrees F or colder.	3.9 [3.3]	4.1 [3.8]	2.9	3.1
*				
E:(Improper cooling of cooked foods)				4/1974: 20% believed freezing kills bacteria
Control Zone 5: Freezing				
b-11. Use freezer wrap, aluminum foil, freezer bag or other sound packaging over commercial wrap to prevent juices from contacting other foods or freezer surfaces.	3.5 [3.0]	NOT RATED	3.7	3.7
#				
E: (cross-contamination)				
*Essential (Based on expert risk rating and epidemiological information)				
#Advised				
E: Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.				
1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets].				
2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets].				
3 Consumer expert average rating for knowledge or practice of behavior.				
4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.				

Table 2-4

TABLE 2, continued

	1 Raw/	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 2: HOME STORAGE OF MEAT AND POULTRY, continued				
Control Zone 5 - Freezing, continued				
b-12. Wash hands with soap and water # for 20 seconds before rewrapping products whose packaging was damaged in transport. E: (colonized person or victim contaminating food)	2.9 [2.1]	3.6 [2.5]	3.8	4.0
b-13. Use thermometer to verify 0 degrees F freezer temperature or colder.	2.5 [2.0]	2.6 [2.1]	3.8 2.8	4.2 (use therm.) 3.7 (keep at 0)
b-14. Freeze foods with "keep frozen" # label.	3.1 [3.1]	3.1 [3.4]	2.4	2.0
b-15. Freeze raw meat and poultry that will not be used within 2 days.	2.6 [2.4]	DO NOT RATE	2.5	3.2
b-16. Store meat and poultry in back of freezer rather than in door.	1.8 [2.0]	2.1 [2.1]	3.3	3.5
b-17. Maintain a clean freezer.	2.1 [2.1]	2.2 [2.6]	2.5	3.5
b-18. Date undated products so they can be used within safe time limits that will also assure quality (see Appendix for Safe Food Book, p. 14 chart on Cold Storage).	1.8 [1.8]	2.0 [1.8]	3.0	4.0
b-19. Use dated or undated products within safe time limit.	2.3 [2.3]	2.4 [2.4]	3.0	3.8
b-20. If freezer fails, keep door * closed and use cold food within 2 days (discard if not cold). If freezer compartment fails, keep door closed and use cold food within 8 hours.[revised]	4.1 [3.6]	4.0 [4.3]	3.0	3.1 4/FDA, 1988: 12% would cook meat de- frosted over wkend & warmer than fridge temp. 6% would test, 3% would give to pet, 2% would refreeze.

E: (Mistakes in thawing cooked foods)

*Essential (Based on expert risk rating and epidemiological information)

#Advised

E Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.

- 1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets]
- 2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets]
- 3 Consumer expert average rating for knowledge or practice of behavior.
- 4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.

TABLE 2, continued

	1 Raw/	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 2: HOME STORAGE OF MEAT AND POULTRY, continued				
Control Zone 6 - Disposal				
b-21. Properly dispose of outdated or * other potentially unsafe frozen or refrigerated products in a way that prevents consumption by humans or animals.	3.5 [3.5]	3.6 [3.6]	3.1	3.6
PROCESS 3: PREPARATION OF MEAT AND POULTRY				
Control Zone 7 - Preliminaries				
c-1. Wash hands (gloved or not) with * soap and water for 20 seconds beginning preparation, after handling raw meat and poultry, after touching animals, using bathroom, or changing diapers. E:(colonized person or victim contaminating food)	4.2 [3.4]	4.9 [4.3]	2.4	3.1 4/1988, FDA 24% would only rinse or wipe hands, 2% would continue cooking, after handling raw meat or poultry.
c-2. Dry hands on paper towel or use cloth towels and place in laundry after use.	2.7 [2.1]	2.9 [2.6]	3.3	3.7
c-3. Wear clean plastic glove over # skin cut. E:(colonized person or victim contaminating food [or acquiring infection])	3.0 [2.8]	3.7 [3.3]	3.7	4.0
c-4. Clean counters, equipment, * utensils with soap and water immediately after use. E: (dirty equipment)	4.0 [3.6]	3.3 [3.2]	2.9	3.6 FDA, 1988: 29% would rinse or wipe cutting bd or use as is. 25% would rinse or wipe knife, use as is
*Essential (Based on expert risk rating and epidemiological information)				
#Advised				
E: Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.				
1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in parentheses].				
2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in parentheses].				
3 Consumer expert average rating for knowledge or practice of behavior.				
4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.				

Table 2-6

TABLE 2, continued

	1	2	3(Expert)	4(Survey)
	Raw/	Cooked	Knowl/Prac	
PROCESS 3: PREPARATION OF MEAT AND POULTRY, continued				
Control Zone 7 - Preliminaries, continued				
	3.0	3.5	1.9	2.1
c-5. Sneeze away from food.	[2.7	3.4]		
# E: (Carrier or victim contaminating food)				
c-6. Thaw only in refrigerator, under	3.3	3.6	3.0	3.6
# cold running water, or in	[2.5	3.2]		
microwave (followed by immediate cooking).				
E: (Mistakes in thawing)				4/1983,OR: 27% would thaw turkey at room temp.
c-7. Marinate raw product in	3.8	Not	2.9	3.0
# refrigerator.	[2.7]	Rated		
c-8. Stuff raw product immediately	3.8	Not	3.0	2.9
* before cooking.	[3.9]	Rated		
c-9. Avoid tasting raw product.	4.7	Not	3.1	3.1
*	[4.4]	Rated		

Control Zone 8 - Initial Cooking by Consumer

	2.7	2.7	3.0	3.3
c-10. Cook products immediately	[2.9	2.8]		
# after thawing.	But see c-6			
c-11. Use meat thermometer to judge	3.8	Not	2.9 therm.	3.6
* safe internal temperature of	[3.6]	Rated	3.0 temp.	3.1
meat and poultry over 2 inches thick (160 degrees F or higher for beef and pork, 180 degrees or higher for poultry).				4/1988,FDA 44% never use meat therm. or pop-up timer for turkeys (3% sometimes use; 14% use as major doneness cue for roast beef; 11% would cook whole turkey at less than 325 degrees for part or all of time.
E: (Inadequate cooking/canning/heat processing)				

*Essential (Based on expert risk rating and epidemiological information)

#Advised

E: Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.

- 1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets]
- 2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in parentheses.]
- 3 Consumer expert average rating for knowledge or practice of behavior.
- 4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.

TABLE 2, continued

	1 Raw/	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 3: PREPARATION OF MEAT AND POULTRY, continued				
Control Zone 8 - Initial cooking, continued				
c-12	Use recipe, internal meat color	3.4	NOT	2.0
*	or [clear] juice color to judge doneness of meat and poultry two inches or less in thickness. E:(Undercooking)	[3.7]	RATED	2.1
				4/1988, FDA: 25% would serve under- cooked ham- burgers (rare, pink)
c-13.	Use rotating microwave pad (or	3.3	2.4	4.0
*	similar energy dispersion device) [2.8 if microwaving. E:(Undercooking)	2.1]		3.9
c-14.	Use microwave temperature	3.1	2.4	3.4
*	probe if microwaving. E:(Undercooking)	[2.7	2.3]	4.0
c-15.	Based on microwave cooking	3.8	3.0	3.4
*	directions, increase microwaving time if necessary for product to reach safe internal temperature. E:(Undercooking)	[3.7	2.8]	3.6
c-16.	Let microwaved food stand for	3.5	2.7	2.7
*	recommended number of minutes before serving. E:(Undercooking)	[2.7	2.2]	2.9
c-17.	Use crockpots, smokers, or	4.2	3.5	2.7
*	slow cookers according to label directions. E:(Undercooking)	[3.7	3.2]	2.5
			USDA DOES NOT RECOMMEND	

*Essential (Based on expert risk rating and epidemiological information)

#Advised

E: Failure in parenthesis contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.

- 1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets].
- 2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets].
- 3 Consumer expert average rating for knowledge or practice of behavior.
- 4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.

Table 2-8

TABLE 2, continued

	1 Raw/	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 3: PREPARATION OF MEAT AND POULTRY, continued				
Control Zone 8 - Initial cooking, continued				
c-18. Avoid tasting foods in process.	4.3	2.7	3.1	3.7
* E: (Undercooking)	[4.0	[3.1]		
c-19. Avoid interrupted cooking.	3.9	3.2	3.4	2.9
* [3.5	2.7]			
c-20. Avoid contact of raw juices	4.5	4.2	3.7	3.6
* with hands, equipment,	[3.4	3.6]		
environment, or with any other				4/1988,
food, raw or cooked.				FDA: 6%
E:(Cross-contamination)				thought
				juices
				germ-free

PROCESS 4: SERVING MEAT AND POULTRY

E:(Lapse of 12 hours or more between cooking and eating)

Control Zone 9 - Room Temperature Holding

d-1. Wash hands with soap and water	NOT	3.5	3.4	3.6
* for 20 seconds before serving	RATED	[3.0]		
cooked food.				
E: (Carrier or victim contaminating food)				
d-2. Serve cooked products on clean	NOT	3.7	2.0	2.9
* plates and with clean utensils	RATED	[3.5]		
and clean hands.				
d-3. In environmental temperatures	NOT	3.9	3.0	3.4
* 90 degrees F or above, leave	RATED	[4.0]		
out cooked food no longer than				
1 hour before refrigerating,				
refreezing or reheating.				
E: (Improper cooling)				

*Essential (Based on expert risk rating and epidemiological information)

#Advised

E: Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.

- 1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets].
- 2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets].
- 3 Consumer expert average rating for knowledge or practice of behavior.
- 4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.

Table 2-9

TABLE 2, continued

	1 Raw/	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 4: SERVING MEAT AND POULTRY, continued				
Control Zone 9 - Room temperature holding, continued				
d-4. In environmental temperatures	NOT	3.9	3.0	3.3
* below 90 degrees F, leave out	RATED [3.2]			
cooked food no longer than				4/1988, FDA:
2 hours before refrigerating,				75% wd cool
refreezing or reheating.				to room temp
E:(Improper cooling)				but only 14%
				might leave
				out more
				(see below) than 2 hr.

Control Zone 10 - Hot Holding

d-5. Hold hot food above 140 degrees	NOT	3.8	3.3	3.5
* Fahrenheit.	RATED [4.2]			
E:(Improper hot holding)				

Control Zone 11 - Eating

d-6. Wash hands with soap and water	NOT	3.0	2.6	3.0
* for 20 seconds before eating	RATED [2.5]			
cooked food.				
E:(Carrier or victim contaminating food)				
d-7. Avoid dipping personal spoon in	NOT	3.2	2.1	3.3
# serving dish.	RATED [3.0]			
E:(Carrier or victim contaminating food)				
*Essential (Based on expert risk rating and epidemiological information)				
#Advised				

E: Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.

- 1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets].
- 2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets].
- 3 Consumer expert average rating for knowledge or practice of behavior.
- 4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.

4/1988, FDA: 12% think fried chicken left on counter overnight would be safe to eat next day without reheating; 14% think reheating would make it safe to eat.

TABLE 2, continued

	1 Raw/	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 5: HANDLING LEFTOVERS				
E:(Use of leftovers)				
Control Zone 12 - Sanitation				
e-1. Wash hands with soap and water * for 20 seconds before handling leftovers. E: (Colonized person contaminating food)	NOT RATED [2.6]	3.6	3.4	3.4
e-2. Use clean surfaces and utensils. * E: (dirty equipment)	NOT RATED [3.1]	4.2	2.4	2.9
e-3. Remove stuffing before cooling * or freezing. E:(Improper cooling)	NOT RATED [3.8]	4.2	3.4	3.3
Control Zone 13 - Cold Storage				
e-4. Refrigerate or freeze cooked * leftovers in small, covered shallow containers within 2 hours after cooking. E:(Improper cooling)	NOT RATED [4.4]	4.4	3.4	4.0 4/1988, FDA: 67% would leave in cooking pot or 1 large container; 14% might leave at rm. temp. more than 2 hr.
e-5. Leave airspace around packaged * leftovers in refrigerator or freezer. E:(Improper cooling)	NOT RATED [2.7]	3.5	3.9	4.0
e-6. Date leftovers to allow use # within safe time period (see APPENDIX for Safe Food Book, p. 14 chart on Cold Storage.)	NOT RATED [2.4]	3.0	3.8	4.2
*Essential (Based on expert risk rating and epidemiological information)				
#Advised				
E: Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.				
1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets].				
2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets].				
3 Consumer expert average rating for knowledge or practice of behavior.				
4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.				

TABLE 2, continued

		1 Raw/	2 Cooked	3(Expert) Knowl/Prac	4(Survey)
PROCESS 5: HANDLING LEFTOVERS, continued					
Control Zone 13 - Cold Storage, continued					
e-7.	Avoid refreezing leftovers that have been frozen, thawed and reheated.	NOT RATED	2.2 2.1	3.2	3.3
e-8. #	Avoid tasting old leftovers to determine food safety.	NOT RATED	3.5 3.2	3.3	3.5 4/1983, OR: 45% would finger or taste.
Control Zone 14 - Reheating Cooked Leftovers					
e-9. *	Cover and reheat leftovers to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, "wet" foods; 165 degrees F for all others. E:(Inadequate reheating of cooked foods)	NOT RATED	4.0 [3.7]	3.7	4.0 4/1988, FDA: 21% heat to bubbling; 8% use thermom. or probe.
Control Zone 15 - Disposal					
e-10.	Discard leftovers that have been chilled and reheated more than twice.	NOT RATED	2.7 [2.8]	3.5	3.3
e-11. *	Discard unsafe leftovers in garbage disposal or in tightly wrapped packages that cannot be consumed by people or animals.	NOT RATED	3.4 [3.1]	3.9	4.0
e-12. *	If in doubt, discard leftovers as in item 11, above.	NOT RATED	3.7 [3.8]	3.4	3.6 4/1988, FDA: 9% thought food could not be spoiled if it looked or smelled O.K. 6% weren't sure.
*Essential (Based on expert risk ratings and epidemiological information)					
#Advised					
E: Failure in parentheses contributed to home outbreaks of foodborne illness, 1973-82. Not necessarily direct relationship with this behavior.					
1 Average rating of microbial risk if behavior not performed for raw or partially cooked meat or poultry [advisory committee ratings in brackets].					
2 Average rating of microbial risk if behavior not performed for fully cooked meat or poultry [advisory committee ratings in brackets].					
3 Consumer expert average rating for knowledge or practice of behavior.					
4 Survey findings in last 6 years indicate (adjusted) level of consumer knowledge/practice. Blank indicates no information available.					

TABLE 3

**Preventing Foodborne Illness:
19 Most Important Handling Behaviors for Meat and Poultry
(Survey of Selected Expert Microbiologists)**

A survey of 11 experienced microbiologists from government, industry and universities concluded there is a "high to very high" microbiological risk (risk of enough contamination at the time of consumption to cause illness in a high-risk consumer) if the following food handling behaviors are not performed. The microbiologists had an average of 22 years experience in food microbiology.

The microbiologists were asked to rate the microbial risk of not performing 123 specific food handling behaviors for two product categories (raw or partially cooked, and fully cooked), using a scale of 1 (no microbial risk) to 5 (very high microbial risk).

The microbiologists gave average ratings of 4.0 or greater to 19 behaviors. Those are listed below chronologically, within the food handling process under the direct control of the home food handler. Although the behaviors are not in rank order, the average rating of microbial risk and standard deviation are indicated in parentheses after each behavior.

Codes in the left margin for each behavior identify the food safety principle being violated if a behavior is not carried out. TT = Time-temperature abuse (C for cold, H for hot); XC = Cross-contamination; UC = Undercooking; UR = Under-reheating.

PROCESS 1: ACQUISITION

Control Zone 1: Planning Food Acquisition

- TT Plan to shop for cooked meat and poultry products last.** (mean = 4.0; S.D.=0.9) [for raw or partially cooked, mean=3.7 and S.D.=1.3]

Control Zone 2: Obtaining Food

- TT-C Buy meat and poultry products labeled "Keep Refrigerated" only if they are stored in a refrigerated meat case.** (for fully cooked, mean=4.9 and S.D.=0.3; for raw or partially cooked, mean=4.7 and S.D.=0.6)
- XC Buy packaged, fully cooked meat and poultry only if packaging is sound (examples: undented cans, refrigerated/frozen products without tears in packaging).** (mean=4.1; S.D.=1.0) [for raw or partially cooked, mean=3.5 and S.D.=1.0]
- TT-C Buy frozen, fully cooked meat and poultry products only if they appear frozen solid to the touch.** (mean=4.2 and S.D.=1.1) [for raw or partially cooked, mean=3.9 and S.D.=1.0]

TABLE 3, continued

PROCESS 1: ACQUISITION, CONTINUED

- XC Buy fully cooked meat and poultry products from deli refrigerated display case only if unpackaged products are not in contact with other unpackaged raw or cooked products. (mean=4.5; S.D.=0.9) [for raw or partially cooked, mean=3.6 and S.D.=1.2]

PROCESS 2: HOME STORAGE OF MEAT AND POULTRY

Control Zone 4: Refrigeration

- XC Use plastic bags or aluminum foil over commercial packaging or place raw product on plate to prevent raw juices from dripping on other foods or refrigerator surfaces. (mean=4.1 and S.D.=1.3) [Not Rated for fully cooked]
- TT-C Refrigerate meat and poultry products with "Keep Refrigerated" label. (for fully cooked, mean=4.8 and S.D.=0.4; for raw or partially cooked, mean=4.5 and S.D.=0.8)
- TT-C If refrigerator fails, keep door closed and, within 6 hours, reheat fully cooked meat and poultry products OR place in environment 40 degrees F or colder. (mean=4.1; S.D.=1.0) [for raw or partially cooked, mean=3.9 and S.D.=1.0]

Control Zone 5: Freezer Storage

- TT-C If freezer fails, within 2 days refreeze, cook or discard products. [advice statement later modified.] (for fully cooked, mean=4.0 and S.D.=1.0; for raw or partially cooked, mean=4.1 and S.D.=1.1)

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Control Zone 7: Preliminaries

- XC Wash hands (gloved or not) with soap and water for 20 seconds before beginning preparation, after handling raw meat and poultry, after touching animals, using bathroom, or changing diapers. (for fully cooked meat or poultry, mean=4.9 and S.D.=0.3; for raw or partially cooked, mean=4.2 and S.D.=1.1)
- XC Clean counters, equipment, utensils with soap and water immediately after use with raw or partially cooked meat or poultry (mean=4.0; S.D.=1.3) [for fully cooked, mean=3.3 and S.D.=1.3]
- UC Avoid tasting raw meat and poultry. (mean=4.7; S.D.=0.6) [Not rated for fully cooked; also see Zone 8, below]

TABLE 3, continued

PROCESS 3: PREPARATION, continued

Control Zone 8: Initial Cooking/Reheating by Consumer

- UC [For use with raw products] use crockpots, smokers, or slow cookers according to label directions. (mean=4.2; S.D.=1.0) [for fully cooked, mean=3.5 and S.D.=1.3; USDA does not recommend using these appliances for completing the cooking of partially cooked products or for reheating fully cooked products.]
- UC Avoid tasting raw or partially cooked meat or poultry during cooking. (mean=4.3; S.D.=0.8) [for reheating cooked foods, mean=2.7 and S.D.=1.6]
- XC Avoid contact of juices from raw meat or poultry with hands, equipment, environment or any other food, raw or cooked. (for raw or partially cooked products, mean=4.5 and S.D.=0.7; for fully cooked, mean=4.2 and S.D.=1.4) [statement confusing; later revised]

PROCESS 5: HANDLING LEFTOVERS

Control Zone 12: Sanitation

- XC Use clean surfaces and utensils when handling cooked meat and poultry leftovers. (mean=4.2 and S.D.=1.1) [Not rated for raw or partially cooked]
- TT-C Remove stuffing from cooked meat or poultry before cooling or freezing leftovers. (mean=4.2 and S.D.=1.0) [Not rated for raw or partially cooked]

Control Zone 13: Cold Storage

- TT-C Refrigerate or freeze cooked leftovers in small, covered, shallow containers within 2 hours after cooking. (mean=4.4 and S.D.=0.9) [Not rated for raw or partially cooked]

Control Zone 14: Reheating Cooked Leftovers

- UR Cover and reheat leftovers to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, wet foods; 165 degrees F for all others). (mean=4.0; S.D.=1.2) [Not rated for raw or partially cooked]

TABLE 4

**Preventing Foodborne Illness:
9 Most Important Handling Behaviors for Meat and Poultry
(National Advisory Committee on Microbiological Criteria for Foods)**

On average, ten members of the National Advisory Committee on Microbiological Criteria for Foods who completed the questionnaire concluded there is a "high to very high" microbiological risk (risk of enough contamination at the time of consumption to cause illness in a high-risk consumer) if the following food handling behaviors are not performed.

After hearing a briefing on the responses of expert microbiologists, the advisory committee had offered to rate the microbial risk of not performing 123 specific food handling behaviors for two product categories (raw or partially cooked, and fully cooked), using a scale of 1 (no microbial risk) to 5 (very high microbial risk). Ten members of the committee, with an average of 21 years experience in microbiology, epidemiology or a related discipline actually completed the questionnaire.

The committee members gave an average rating of 4.0 or more to nine behaviors. The nine behaviors are presented chronologically below, within the food handling process under the direct control of the home food handler. Some behaviors apply to only fully cooked, some apply only to raw or partially cooked, and some apply to both types of products. Although the behaviors are not in rank order, the mean rating of microbial risk and standard deviation are indicated in parentheses after each behavior.

Codes in the left margin for each behavior identify the food safety principle being violated if a behavior is not carried out. XC = Cross-contamination; TT = Time-temperature abuse (C for cold, H for hot); UC = Undercooking; UR = Under-reheating.

PROCESS 1: ACQUISITION

Control Zone 2: Obtaining Food

- TT-C Buy fully cooked meat and poultry products labeled "Keep Refrigerated" only if they are stored in a refrigerated meat case. (Mean=4.5; S.D.=.53)
[for raw or partially cooked, mean=3.8; S.D.=1.1]

PROCESS 2: HOME STORAGE OF MEAT AND POULTRY

Control Zone 4: Refrigeration

- TT-C Refrigerate meat and poultry products with "Keep Refrigerated" label. (for fully cooked, mean=4.7 and S.D.=.48; for raw or partially cooked, mean=4.1 and S.D.=1.3)

Control Zone 5: Freezer Storage

- TT-C If freezer fails, within two days refreeze, cook or discard fully cooked products. [Advice statement later revised.] (Mean=4.3; S.D.=.82)
[for raw or partially cooked, mean=3.6 and S.D.=1.3]

TABLE 4, continued

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Control Zone 7: Preliminaries

- XC [When handling cooked meat or poultry], wash hands (gloved or not) with soap and water for 20 seconds before beginning preparation, after handling raw meat and poultry, after touching animals, using bathroom, or changing diapers. (Mean=4.3; S.D.=.82) [for raw or partially cooked, mean=3.4 and S.D.=1.2]
- UC Avoid tasting raw meat and poultry. (Mean=4.4; S.D.=.84) [NOT RATED FOR FULLY COOKED]

Control Zone 8: Initial Cooking/Reheating by Consumer

- UC Avoid tasting [raw or partially cooked meat or poultry] foods in process. (Mean=4.0; S.D.=1.1) [for fully cooked, mean=3.1; S.D.=1.5]

PROCESS 4: SERVING

Control Zone 9: Room Temperature Holding

- TT-C In environmental temperatures 90 degrees F or above, leave out cooked food no longer than 1 hour before refrigerating, refreezing, or reheating. (Mean=4.0; S.D.=.82) [NOT RATED FOR RAW OR PARTIALLY COOKED]

Control Zone 10: Hot Holding

- TT-H Hold hot food above 140 degrees. (Mean:4.2; S.D.=1.0) [NOT RATED FOR RAW OR PARTIALLY COOKED]

PROCESS 5: HANDLING LEFTOVERS

Control Zone 13: Cold Storage

- TT-C Refrigerate or freeze cooked leftovers in small, covered, shallow containers within 2 hours after cooking. (Mean=4.4; S.D.=.70) [NOT RATED FOR RAW OR PARTIALLY COOKED]

TABLE 5

**Preventing Foodborne Illness:
7 Most Important Handling Behaviors for Meat and Poultry
(As Agreed Upon by Two Expert Groups)**

Two separate groups -- 11 selected microbiologists from government, industry and universities, and 10 members of the National Advisory Committee on Microbiological Criteria for Foods -- agreed that there is a "high to very high" microbiological risk (risk of enough contamination at the time of consumption to cause illness in a high-risk consumer) if the following food handling behaviors are not performed.

The individuals in each group were asked at different times to rate the microbial risk of not performing 123 specific food handling behaviors for two product categories (raw or partially cooked, and fully cooked), using a scale of 1 (no microbial risk) to 5 (very high microbial risk). The members of the advisory committee, which is composed of microbiologists, epidemiologists and other food science experts, had heard a briefing on the results of the survey of selected microbiologists.

Both groups gave average ratings of 4.0 or greater to 7 behaviors. (Each group also gave average ratings of 4.0 or above to additional behaviors. Those are shown in Tables 3 and 4.) The 7 behaviors both groups rated 4.0 or above are listed below chronologically, within the food handling process under the direct control of the home food handler. Although the behaviors are not in rank order, the average rating of microbial risk and standard deviation are indicated in parentheses after each behavior. **nac= rating of national advisory committee members; epm = rating of selected expert microbiologists**

Codes in the left margin for each behavior identify the food safety principle being violated if a behavior is not carried out. TT =Time-temperature abuse (C for cold, H for hot); XC = Cross-contamination; UC = Undercooking; UR = Under-reheating.

PROCESS 1: ACQUISITION

Control Zone 2: Obtaining Food

TT-C Buy meat and poultry products labeled "Keep Refrigerated" only if they are stored in a refrigerated meat case.

nac: for fully cooked, mean=4.5 and S.D.=.53;
for raw or partially cooked, mean=3.8 and S.D.=1.1
epm: for fully cooked, mean=4.9 and S.D.=0.3;
for raw or partially cooked, mean=4.7 and S.D.=0.6)

PROCESS 2: HOME STORAGE OF MEAT AND POULTRY

Control Zone 4: Refrigeration

TT-C Refrigerate meat and poultry products with "Keep Refrigerated" label.

nac: for fully cooked, mean=4.7 and S.D.=.48;
for raw or partially cooked, mean=4.1 and S.D.=1.3
epm: for fully cooked, mean=4.8 and S.D.=0.4;
for raw or partially cooked, mean=4.5 and S.D.=0.8)

TABLE 5, continued

PROCESS 2: HOME STORAGE, continued

Control Zone 5: Freezer Storage

- TT-C **If freezer fails, within 2 days refreeze, cook or discard products.**
[advice statement later modified.]

nac: for fully cooked, mean=4.3 and S.D.=.82;
for raw or partially cooked, mean=3.6 and S.D.=1.3
epm: for fully cooked, mean=4.0 and S.D.=1.0;
for raw or partially cooked, mean=4.1 and S.D.=1.1)

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Control Zone 7: Preliminaries

- XC **Wash hands (gloved or not) with soap and water for 20 seconds before beginning preparation, after handling raw meat and poultry, after touching animals, using bathroom, or changing diapers.**

nac: for fully cooked, mean=4.3 and S.D.=.82;
for raw or partially cooked, mean=3.4 and S.D.=1.2
epm: for fully cooked meat or poultry, mean=4.9 and S.D.=0.3;
for raw or partially cooked, mean=4.2 and S.D.=1.1)

- UC **Avoid tasting raw meat and poultry.** [Not rated for fully cooked; also see Zone 8, below]

nac: for raw, mean=4.4 and S.D.=.84
epm: for raw, mean=4.7 and S.D.=.60

Control Zone 8: Initial Cooking/Reheating by Consumer

- UC **Avoid tasting raw or partially cooked meat or poultry during cooking.**

nac: for reheating cooked foods, mean=4.0 and S.D.=1.1
for raw or partially cooked, mean=3.1 and S.D.=1.5
epm: for reheating cooked foods, mean=2.7 and S.D.=1.6
for raw or partially cooked, mean=4.3 and S.D.=4.3

PROCESS 5: HANDLING LEFTOVERS

Control Zone 13: Cold Storage

- TT-C **Refrigerate or freeze cooked leftovers in small, covered, shallow containers within 2 hours after cooking.** [not rated for raw or partially cooked]

nac: mean=4.4 and S.D.=.70
epm: mean=4.4 and S.D.=.90

TABLE 6
EPIDEMIOLOGY DATA BASE

The following factors contributed to more than 1 percent of 345 recognized outbreaks of foodborne disease in homes, United States, 1973-1982. (Source: Bryan, "Risks of Practices, Procedures and Processes That Lead to Foodborne Disease," Journal of Food Protection 51: August 1988.). Practices that contributed to disease frequently traced to meat or poultry food vehicles are printed in boldface. **Not all or even most outbreaks were necessarily associated with meat or poultry.**

High and Medium-Risk Practices

Contributory factor	Number of Outbreaks and %	Notes
PROCESS 1: ACQUISITION		
Contaminated raw food/ingredient	145 (42%)	Only raw milk purchase under direct control of home food handler; primarily Norwalk-like gastroenteritis from raw clams and oysters, bacteriosis from raw milk containing <u>C. jejuni</u> or <u>Salmonellae</u> , trichinosis from undercooked pork that contained <u>Trichinella spiralis</u> . Raw meat, poultry frequently contaminated with <u>Salmonellae</u> or other bacteria.
Obtain food from unsafe source	99 (28.7%)	e.g., shellfish from sewage-contaminated water; not associated with meat or poultry.
Mistaken for foods	24 (7%)	Not associated with meat, poultry.
PROCESS 2: HOME STORAGE		
Toxic containers, pipelines	12 (3.5%)	Primarily metal poisoning; may not be under direct control.
PROCESS 3: PREPARATION		
*Improper thawing (Incomplete, or left at room temperature or in water bath too long)	0 0%	Nevertheless, may be high risk of illness from improper thawing of cooked food. Incomplete thawing of turkeys and other large raw pieces is sometimes followed by undercooking insufficient to kill pathogens.
Improper fermentation	16 (4.6%)	Not often associated with meat, poultry products

*Author believes risk is greater than outbreak records indicate.

TABLE 6

EPIDEMIOLOGY DATA BASE: High and Medium-Risk Practices, continued

PROCESS 3: PREPARATION, continued

Inadequate cooking/canning/ heat processing	108 (31.3%)	If time-temperature values inadequate, risks are high.
*Lapse of 12 or more hours between preparing and eating	44 (12.8%)	Time factor; food abuse also assumed.

PROCESS 4: SERVING

*Cross-contamination	11 (3.2%)	From raw foods to cooked foods or foods that will not be further cooked. Although not high on list of contributing factors, home handling offers many possibilities for cross-contamination.
Colonized person handling implicated food	34 (9.9%)	Many "carriers" may actually be victims.
Improper cooling	77 (22.3%)	Most important contributory factor for all periods of review; includes holding foods at room/outside temp, refrigerating foods in large, deep containers.
Improper hot holding	11 (3.2%)	At bacterial incubation temp.

PROCESS 5: HANDLING LEFTOVERS

Use of leftovers	9 (2.6%)	Includes lapse of 12 or more hours between preparation and eating; food abuse also assumed.
*Inadequate reheating	12 (3.5%)	Risk may be greater than that of improper cooking, because cooked and chilled foods are frequently merely warmed up rather than thoroughly heated. More organisms of concern will be on foods subjected to time- temp. abuse than would be present on raw foods.

*Author believes risk is greater than outbreak records indicate.

TABLE 6, continued
EPIDEMIOLOGICAL DATA BASE
Low-Risk Practices

Each of these practices contributed to fewer than 1 percent of 345 outbreaks of foodborne disease that resulted because of mishandling and/or mistreatment of foods in homes, United States, 1973-82.

Contributory factor	Number of outbreaks	Notes
Intentional additives	8	Overemphasized as cause of foodborne illness.
Incidental additives	3	
Contaminated water	2	Unless harvesting own shellfish, usually not under direct control of home food handler. (Indirect control through local regulatory authorities.)
Inadequate acidification	2	Insufficient concentration of acid added to acidified foods.
Improper cleaning of equipment/utensils	1	
Poor dry storage practices	1	
Inadequate preservation	1	
Inadequate drying	1	
Faulty sealing	1	
Fly contamination of food	1	

TABLE 7

Food Safety Issues: What the Experts Think

Eleven experienced food microbiologists, 10 members of the National Advisory Committee on Microbiological Criteria for Foods, and 7 consumer experts were asked: "What do you think will be the greatest microbiological food safety concerns over the next five years?" Ten members of the National Advisory Committee on Microbiological Criteria for Foods were asked the same question. On average, the experts have at least 20 years of experience in their area of expertise.

A list of topics was provided, and respondents were invited to list other topics. (The consumer experts were given a slightly different list than the two groups of scientists.) Their responses are shown below. Totals do not add up to 100%, because the experts were asked to circle all issues of concern.

FOOD SAFETY TOPIC	Percentage (%) who believe topic will be great food safety concern		
	Expert panel	NACMCF	Consumer ex.
<u>Salmonella</u> in general	90.9	90	not asked
<u>Listeria monocytogenes</u>	72.7	80	not asked
Products in vacuum, mixed-atmosphere or other novel packaging	72.7	60	100%
Training of commercial food handlers	72.7	70	71.4%
Partially cooked products in general	72.7	60	85.7%
Education of home food handlers	63.6	80	85.7%
<u>Campylobacter jejuni</u>	63.6	30	not asked
Refrigerated products in general	63.6	30	42.9%
Products hot at purchase (whether partially or fully cooked)	54.5	20	71.4%
<u>E coli 0157:H7</u>	45.5	60	not asked
Raw products in general	27.3	10	57.1%
Shelf-stable products	not asked	not asked	14.3%
Frozen products	not asked	not asked	14.3%

Table 7-1

TABLE 7, continued

Comments: (A-xx signifies one of the 10 members of the National Advisory Committee on Microbiological Criteria for Foods who completed the questionnaire; C-xx signifies one of the 7 consumer experts; E-xx signifies one of the selected expert microbiologists.)

About Listeria monocytogenes, "Not caused by the home." (E-08) "A regulatory problem more than a health problem." (A-04)

About training of commercial food handlers, "This depends on the pathogen load on the food from the wholesale system." (E-08)

About partially cooked products, "Only if certain minimum internal temperatures are not achieved by the processor." (A-03)

About products hot at purchase, "Very important." (E-08)

Other topics listed:

"Proper training of regulatory officials and inspectors, food processors, commercial food handlers, home food handlers, and children could prevent many, many cases of foodborne disease. Ignorance is our biggest problem." (A-04)

"Education of grammar and high school students." (A-06)

"Education of food service food handlers." (A-05)

"Education and certification of government R & D and inspection personnel, both national and local, in HACCP and food safety technology." (E-08)

"We won't have control UNTIL a processor must do a full HACCP and have an approved TQC BEFORE they get a license. Facility construction has little impact." (E-08)

"Clean up the farms and human waste disposal systems." (E-08)

"Salmonella in eggs." (A-08)

"Staphylococcus aureus and Clostridium perfringens. After Salmonella, they still account for a major portion of documented outbreaks." (A-05)

"Microbiological standards - regulatory problems." (A-04)

"Education of nontraditional persons, such as youth and men, handling food." (C-01)

"Pathogens growing at refrigerator temperature and below." (C-01)

TABLE 8

Care Labeling as an Educational Tool

Almost all of the respondents surveyed during the course of the project believe cooking, storing and handling instructions on certain meat and poultry products would "positively influence consumer behavior, thereby reducing contamination levels at the time of consumption." Ten of the 11 expert microbiologists, 8 of the 10 NACMCF members who completed the questionnaire, and all 7 of the consumer experts agreed that care labeling would have a positive effect on behavior.

The microbiologists and members of the advisory committee were asked to identify all meat and poultry product categories for which it would be most useful. At least 50 percent of either group identified the following product categories:

Care labeling useful for:	Percentage (%) who agree	
	Expert panel	NACMCF members
(1) Raw products in general	80	70%
(2) Raw, ground products	40	50%
(3) Raw cuts in vacuum or mixed-atmosphere packaging	50	50%
(4) Dried, breaded, marinated, stuffed or other semi-prepared (non-heat-processed)	50	60%
(5) Partially cooked products in general	70	70%
(6) Partially cooked products, refrigerated at purchase	80	50%
(7) Partially cooked products, frozen at purchase	60	40%
(8) Partially cooked products in vacuum or mixed-atmosphere packaging	80	50%
(9) Fully cooked - hot at purchase	70	60%
(10) Fully cooked - refrigerated at purchase	70	70%
(11) Fully cooked - vacuum or mixed-atmosphere packaging	70	70%
(12) Mail-order products	70	60%

Table 8-1

TABLE 8, continued

Comments: (A-xx = member of National Advisory Committee on Microbiological Criteria for Food; E = member of expert panel of microbiologists; C = consumer expert)

- (1) A-04 noted, "Keep refrigerated," presumably as suggested care labeling.
A-10 noted, "cooking and cross-contamination."
- (2) A-10 noted, "cooking and cross-contamination."
- (3) A-01 noted, "Be careful."
- (4) A-10 noted, "cooking."
- (5) A-10 noted, "cooking."
- (6) A-10 noted, "adequate cooking."
- (7) A-10 noted, "adequate cooking."
- (8) A-01 noted, "Caveat emptor" [let the buyer beware].
- (9) E-08 noted, "very important."
- (10) E-08 noted, "very important."
- (11) A-01 noted, "Eat at your own risk."
- (12) E-07 noted, "Frozen must be frozen, for raw or partially cooked," and
"Refrigerated must be cold, for fully cooked."

Comments, care labeling in general:

[Care labeling] "would help some, but not a universal in terms of impact."
(A-05)

"To some extent" [care labeling would help]. (E-06)

"When it fits. Also consumer fliers, ads, radio, etc." (C-07)

"All [product categories] would be applicable for care labeling." (A-10)

"Yes, but there will be too much. You need a booklet [Safe Food Book] given to EVERY American." (E-08)

"Consumers should follow manufacturers' instructions for preparing foods."
(A-03)

"Issue of unsafe recommendations -- either on label or packaging, in media stories, or appliance directions, etc., is not addressed [in questionnaire]. Those recommendations often lead to unsafe practices by consumers." (C-01)

Fewer than half of the respondents in each group believe that care labeling would be useful for the following types of meat and poultry products:

Raw cuts other than ground (Raw cuts less than 2 inches thick, raw cuts 2 inches thick or greater)

Fully cooked, shelf-stable products (Respondent A-04 noted, "Keep refrigerated after opening," presumably as suggested care labeling.)

Fully cooked products frozen at purchase

TABLE 9

Credentials of the Experts

The project on risk-based food safety education sought the views of experts in their field. For example, an important criterion the microbiological subcommittee considered in selecting the 12 microbiologists (11 of whom ultimately responded) was a minimum of five years' experience. The criterion was exceeded. On average, the 11 microbiologists had 22 years' experience in food microbiology.

Experience, educational background, and work settings of the experts in the three groups of respondents are described below.

Expert Microbiologists

<u>Average years of experience</u>		
In food microbiology		22 years
In microbiology		23.3 years
<u>Highest degree</u>		
Postdoctoral training		5 (45.5%)
Doctoral degree		4 (36.4%)
Master's degree		2 (18.2%)
<u>Current work setting</u>		
Government		6 (54.5%)
Academic		3 (27.3%)
Industry or trade association		2 (18.2%)
<u>Average years of experience in work setting</u>		
Government	(7 respondents)	16.7 years
Academic	(7 respondents)	12.7 years
Industry	(4 respondents)	7.0 years
Other	(2 respondents)	4.0 years

National Advisory Committee on Microbiological Criteria for Foods

(10 members completed the questionnaire; represent varied disciplines)

<u>Average years of experience</u>		
In microbiology		23.8 years
In food microbiology (or food-related discipline)		24.4 years
(One person did not respond to the first query; a different person did not respond to the second query.)		
<u>Highest degree</u>		
Postdoctoral training		4 (40%)
Doctoral degree		5 (50%)
Bachelor's degree		1 (10%)
<u>Average years in different work settings</u>		
Government	(7 respondents)	9.6 years
Academic	(3 respondents)	6 years
Industry	(4 respondents)	28.2 years

TABLE 9, continued

Consumer Experts

<u>Average years of experience in food and consumer issues</u>	24.1 years
--	------------

<u>Highest degree</u>	
-----------------------	--

(Consumer experts were not asked to provide educational information.)	
---	--

<u>Current work setting</u>	
-----------------------------	--

Government	2
------------	---

Academic	1
----------	---

Industry or trade association	4
-------------------------------	---

<u>Average years in different work settings</u>	
---	--

Government	(4 respondents)	4.7 years
------------	-----------------	-----------

Academic	(5 respondents)	17.8 years
----------	-----------------	------------

Industry	(5 respondents)	12.2 years
----------	-----------------	------------

Other	(2 respondents)	2.0 years
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United States
Department of
Agriculture

Food Safety
and Inspection
Service

Washington, D.C.
20250

APPENDIX A (Questionnaire follows letter)

Dear _____:

Thank you for agreeing to complete our questionnaire on the microbial risk of various food handling practices. The questionnaire has been pretested with other food microbiologists like yourself to make it as valid and easy to complete as possible. We believe that it will require approximately 1-1/4 hours of your time.

Please complete the questionnaire in the next 10 days, and return it in the addressed, franked envelope which has been enclosed. If you have questions, please contact Sharin Sachs at (202) 447-9113.

Once again, thank you. Your efforts will help the Food Safety and Inspection Service plan appropriate food safety education materials.

Sincerely,

Sharin Sachs
Senior Public Affairs Specialist

Carl Custer
Staff Officer



QUESTIONNAIRE

ASSESSING MICROBIOLOGICAL RISK OF SPECIFIC BEHAVIORS IN HANDLING MEAT AND POULTRY PRODUCTS

Name: _____

Organization: _____

Date: _____

BACKGROUND:

The Information and Legislative Affairs Division for the Food Safety and Inspection Service has formed a working group to determine future priorities in food safety consumer education, using a Hazard Analysis Critical Control Points (HACCP) approach. The working group, which includes technical experts from other FSIS programs, has developed an inventory of meat and poultry handling behaviors under the direct control of the food handler. The inventory includes those behaviors known or believed to help prevent bacterial or parasitic foodborne diseases. This questionnaire asks you to assess the microbiological risk if each behavior in that inventory is not carried out properly. The working group will also examine epidemiological and public awareness data.

Your work on this questionnaire will help FSIS revise a major consumer education publication, the "Safe Food Book." It will also help ensure that FSIS educational programs target the food handling behaviors that are (1) most important in preventing foodborne illness and (2) least understood or practiced. Findings will be statistically tabulated and summarized; individuals will not be associated with particular answers.

The questionnaire includes three sections: (1) the inventory of food handling behaviors whose importance you are asked to assess; (2) a request for information about your education, training and experience in this area; and (3) your views on certain food safety education issues.

Please be as thorough and specific as possible; FSIS values your comments. Thank you.

PLEASE READ BEFORE GOING FURTHER

ASSUMPTIONS

1. For purposes of this questionnaire, assume that all meat and poultry products at the time of purchase -- whether raw, partially cooked, or fully cooked -- carry pathogens which will grow under the appropriate time and temperature conditions. (This "worst case" assumption allows the effects of food handling on risk to be rated consistently.)
2. Assume that less contamination at the time of consumption is required to cause foodborne illness in high-risk consumers (SEE DEFINITIONS) than in healthy adults.
3. Assume that all food handling behaviors BEFORE the one being rated were carried out properly (pathogens may have survived but have not multiplied).
4. Assume that thorough cooking or reheating of products cannot be guaranteed AFTER the behavior being rated.

DEFINITIONS

Meat and Poultry Product Categories: For this questionnaire, meat and poultry products have been grouped into two categories -- A and B. Category A includes raw or partially cooked products. Category B includes fully cooked products only. **PLEASE DO NOT CONSIDER** shelf-stable products, dried meat or poultry, or fermented products. The categories are not grouped by species because it is generally recognized that food handling behavior, and not species, plays the largest role in determining contamination levels on food at the time of consumption.

MEAT AND POULTRY PRODUCT CATEGORIES

- * Consider products packed in traditional or novel packaging, such as vacuum or mixed-atmosphere packaging
- * Consider cuts less than 2 inches thick (e.g., chop) and cuts 2 inches thick or greater (roast).

***DO NOT CONSIDER SHELF-STABLE MEAT OR POULTRY PRODUCTS**

CATEGORY A

Raw

*Refrigerated or frozen at time of purchase

*Includes ground products

PARTIALLY COOKED

*Hot, refrigerated or frozen at time of purchase

*Includes deli & take-out foods

CATEGORY B

Fully cooked

*Hot, refrigerated or frozen at time of purchase

*Includes deli & take-out foods

Inventory of Food Handling Behaviors: Those behaviors under the direct control of the home food handler, and known or believed to be important in preventing bacterial and parasitic foodborne illnesses associated with meat and poultry products.

Microbiological Risk: The risk of contamination levels high enough at the time of consumption to cause illness in a high-risk consumer if a behavior is not performed.

High-Risk Consumer: Those individuals who are more vulnerable to foodborne illness than are healthy adults. These include those with incompletely developed, suppressed or weakened immune systems: e.g., infants, children, pregnant women and their fetuses, AIDS or cancer patients or other seriously ill persons, the elderly, antibiotic users, the malnourished and others. Such persons may not always be aware that they are at high risk.

Home Food Handler: For this project, a consumer with the following characteristics: reads at the 10th grade level or above, typically buys a range of raw and processed meat and poultry products in the product categories described earlier, prepares food for him/her self and may prepare food for others in the household, and owns a refrigerator with a freezer compartment, a conventional oven and microwave.

INSTRUCTIONS FOR COMPLETING THE INVENTORY

- A. The following inventory includes behaviors grouped in food handling sequence. It is divided into five processes: acquisition, home storage of meat and poultry, preparation, serving, and handling leftovers. Processes are major categories of identified food handling behaviors. Each process is divided into control zones. Control Zones are distinct stages in the food handling process, each including several behaviors or tasks usually carried out at about the same time and often in the same location. Control Points are specific food handling tasks or behaviors which may be carried out in one or more control zones.
- B. Please use the following rating scale to rate each food handler behavior by circling the number which you consider best represents the extent of microbiological risk to a high-risk consumer, for each of the two product categories, IF the behavior is **NOT** performed. (For convenience, the rating scale appears at the bottom of each page.)
- 1 = No microbiological risk if **behavior NOT performed**
- 2 = Small degree of microbiological risk
- 3 = Moderate degree of microbiological risk
- 4 = High degree of microbiological risk
- 5 = Very high degree of microbiological risk
- 9 = Unable to rate degree of microbiological risk
- C. Please rate each behavior independently of any other. Assume that all food handling behaviors **BEFORE** the one being rated were carried out properly. Assume that thorough cooking or reheating **CANNOT** be guaranteed **AFTER** the behavior being rated.
- D. If you mark a behavior "9", please also circle the control point number and make a note in the margin alongside that behavior.
- E. Please rate each behavior in the sequence that it appears in the questionnaire: first for product category set A, Raw or Partially Cooked Meat & Poultry, then for set B, Fully Cooked Meat & Poultry (if relevant).
- F. Please try to work at an even pace throughout the inventory; do not spend too much time on rating any one behavior, but provide your best professional judgment on each.
- G. Certain statements refer to charts found in the Safe Food Book. For convenience, these charts appear on blue bond as an appendix directly following page 11 of the inventory. The first chart deals with cooking meat and poultry, and the second chart with cold storage of meat and poultry.

THANK YOU VERY MUCH FOR YOUR TIME AND INTEREST
IN THIS IMPORTANT PROJECT

SECTION A

MEAT AND POULTRY PRODUCT HANDLING BEHAVIORS INVENTORY

FOOD HANDLING BEHAVIOR	Extent of Microbiological Risk If Behavior NOT Performed											
	A. Raw or Partially Cooked Meat & Poultry						B. Fully Cooked Meat & Poultry					
PROCESS 1: ACQUISITION												
<u>Control Zone 1 - Planning Food Acquisition</u>												
1. Plan use of food before purchase.	1	2	3	4	5	9	1	2	3	4	5	9
2. Plan to buy from reputable source with no record of unsafe handling.	1	2	3	4	5	9	1	2	3	4	5	9
3. Check to see that home storage is adequate for items to be purchased.	1	2	3	4	5	9	1	2	3	4	5	9
4. Consider outside temperature in planning trip.	1	2	3	4	5	9	1	2	3	4	5	9
5. Plan to shop for food last.	1	2	3	4	5	9	1	2	3	4	5	9
<u>Control Zone 2 - Obtaining Food</u>												
6. Buy packaged meat and poultry only if packaging is sound (examples: undented cans, refrigerated/frozen products without tears in packaging).	1	2	3	4	5	9	1	2	3	4	5	9
7. Buy products labeled "keep refrigerated" only if they are stored in a refrigerated meat case.	1	2	3	4	5	9	1	2	3	4	5	9
8. Buy frozen products only if they appear frozen solid to the touch.	1	2	3	4	5	9	1	2	3	4	5	9
9. Buy products from deli refrigerated display cases only if unpackaged products are not in contact with other unpackaged raw or cooked products.	1	2	3	4	5	9	1	2	3	4	5	9

1=No microbiological risk if behavior NOT performed, 2=Small degree, 3=Moderate degree, 4=High degree, 5=Very high degree, 9=Unable to rate degree of microbiological risk.

FOOD HANDLING BEHAVIOR

Extent of Microbiological Risk If
Behavior NOT Performed

A. Raw or Partially Cooked Meat & Poultry	B. Fully Cooked Meat & Poultry
---	-----------------------------------

PROCESS 1: ACQUISITIONControl Zone 2 - Obtaining Food

- | | | |
|---|-------------|-------------|
| 10. Buy "open dated" products only if label sell-by, use-by, or pull-by date has not expired. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 11. Place meat, poultry, cold foods in shopping cart last. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 12. Place meat and poultry packages in individual plastic bags. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 13. Report problems with packaging, product, storage, sanitation to store management or, if unsatisfied, to local health authorities. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |

Control Zone 3 - Transporting Meat and Poultry

- | | | |
|---|-------------|-------------|
| 14. In climate temperatures 70°F or below, hold cold foods at 40°F in vehicle or plan to place in cold storage within one hour. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 15. Hold hot foods above 140°F in vehicle, <u>OR</u> plan to reheat or place in cold storage within two hours. | DO NOT RATE | 1 2 3 4 5 9 |
| 16. If climate temperature is above 70°F or distance is more than 30 miles, use ice chest for cold items. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |

Process 2: HOME STORAGE OF MEAT AND POULTRYControl Zone 4 - Refrigeration

- | | | |
|---|-------------|-------------|
| 1. Use plastic bags, aluminum foil over commercial packaging or place product on plate to prevent raw juices from dripping on other foods or refrigerator surfaces. | 1 2 3 4 5 9 | DO NOT RATE |
| 2. Wash hands with soap and water for 20 seconds before re-wrapping products whose packaging was damaged during transport. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |

1=No microbiological risk if behavior NOT performed, 2=Small degree, 3=Moderate degree, 4=High degree, 5=Very high degree, 9=Unable to rate degree of microbiological risk.

FOOD HANDLING BEHAVIOR

Extent of Microbiological Risk If
Behavior NOT PerformedA. Raw or Partially
Cooked Meat &
PoultryB. Fully Cooked
Meat & Poultry

Process 2: HOME STORAGE OF MEAT AND POULTRY

Control Zone 4 - Refrigeration

- | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|-------------|---|---|---|---|---|
| 3. Use refrigerator thermometer to verify temperature of 40°F or colder. | 1 | 2 | 3 | 4 | 5 | 9 | 1 | 2 | 3 | 4 | 5 | 9 |
| 4. Refrigerate products with "keep refrigerated" label. | 1 | 2 | 3 | 4 | 5 | 9 | 1 | 2 | 3 | 4 | 5 | 9 |
| 5. Store meat and poultry in back of refrigerator rather than in door. | 1 | 2 | 3 | 4 | 5 | 9 | 1 | 2 | 3 | 4 | 5 | 9 |
| 6. Maintain a clean refrigerator. | 1 | 2 | 3 | 4 | 5 | 9 | 1 | 2 | 3 | 4 | 5 | 9 |
| 7. Refrigerate raw meat and poultry within one hour after removing from meat case. | 1 | 2 | 3 | 4 | 5 | 9 | DO NOT RATE | | | | | |
| 8. Date undated products so they can be used within a safe time limit that will also assure quality (see Appendix for Safe Food Book, p. 14 chart on Cold Storage). | 1 | 2 | 3 | 4 | 5 | 9 | 1 | 2 | 3 | 4 | 5 | 9 |
| 9. Use dated or undated products within a safe time limit that will also assure quality (see Appendix for Safe Food Book, p. 14 chart on Cold Storage). | 1 | 2 | 3 | 4 | 5 | 9 | 1 | 2 | 3 | 4 | 5 | 9 |
| 10. If refrigerator fails, keep door closed and, within six hours, cook products, OR place in environment 40°F or colder. | 1 | 2 | 3 | 4 | 5 | 9 | 1 | 2 | 3 | 4 | 5 | 9 |

Control Zone 5 - Freezing

- | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|-------------|--|--|--|--|--|
| 11. Use freezer wrap, aluminum foil, freezer bag or other sound packaging over commercial wrap to prevent juices from contacting other foods or freezer surfaces. | 1 | 2 | 3 | 4 | 5 | 9 | DO NOT RATE | | | | | |
|---|---|---|---|---|---|---|-------------|--|--|--|--|--|

1=No microbiological risk if behavior NOT performed, 2=Small degree, 3=Moderate degree, 4=High degree, 5=Very high degree, 9=Unable to rate degree of microbiological risk.

FOOD HANDLING BEHAVIOR

Extent of Microbiological Risk If
Behavior NOT Performed

A. Raw or Partially
Cooked Meat &
Poultry

B. Fully Cooked
Meat & Poultry

Process 2: HOME STORAGE OF MEAT AND POULTRY

Control Zone 5 - Freezing

12. Wash hands with soap and water for 20 seconds before re-wrapping product whose packaging was damaged in transport.	1	2	3	4	5	9	1	2	3	4	5	9
13. Use thermometer to verify 0°F freezer temperature or colder.	1	2	3	4	5	9	1	2	3	4	5	9
14. Freeze foods with "keep frozen" label.	1	2	3	4	5	9	1	2	3	4	5	9
15. Freeze raw meat and poultry that will not be used within 2 days.	1	2	3	4	5	9	DO NOT RATE					
16. Store meat and poultry in back of freezer, rather than in door.	1	2	3	4	5	9	1	2	3	4	5	9
17. Maintain a clean freezer.	1	2	3	4	5	9	1	2	3	4	5	9
18. Date undated products so they can be used within safe time limits that will also assure quality (see Appendix for Safe Food Book p. 14 chart on Cold Storage).	1	2	3	4	5	9	1	2	3	4	5	9
19. Use dated or undated products within safe time limit.	1	2	3	4	5	9	1	2	3	4	5	9
20. If freezer fails, within two days refreeze, cook or discard products.	1	2	3	4	5	9	1	2	3	4	5	9

Control Zone 6 - Disposal

21. Properly dispose of outdated or other potentially unsafe frozen or refrigerated products in a way that prevents consumption by humans or animals.	1	2	3	4	5	9	1	2	3	4	5	9
---	---	---	---	---	---	---	---	---	---	---	---	---

1=No microbiological risk if behavior NOT performed, 2=Small degree, 3=Moderate degree, 4=High degree, 5=Very high degree, 9=Unable to rate degree of microbiological risk.

FOOD HANDLING BEHAVIOR

Extent of Microbiological Risk If
Behavior NOT PerformedA. Raw or Partially
Cooked Meat &
PoultryB. Fully Cooked
Meat & Poultry

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Control Zone 7 - Preliminaries

- | | | |
|---|-------------|-------------|
| 1. Wash hands (gloved or not) with soap and water for 20 seconds before beginning preparation, after handling raw meat and poultry, after touching animals, using bathroom, or changing diaper. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 2. Dry hands on paper towels or use cloth towel and place in laundry after use. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 3. Wear clean plastic glove over skin cuts. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 4. Clean counters, equipment, utensils with soap and water immediately after use. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 5. Sneeze away from food. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 6. Thaw only in refrigerator, under cold running water, or in microwave (followed by immediate cooking). | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 7. Marinate raw product in refrigerator. | 1 2 3 4 5 9 | DO NOT RATE |
| 8. Stuff raw product immediately before cooking. | 1 2 3 4 5 9 | DO NOT RATE |
| 9. Avoid tasting raw product. | 1 2 3 4 5 9 | DO NOT RATE |

Control Zone 8 - Initial Cooking by Consumer

[Cook]

[Reheat]

- | | | |
|--|-------------|-------------|
| 10. Cook products immediately after thawing. | 1 2 3 4 5 9 | 1 2 3 4 5 9 |
| 11. Use meat thermometer to judge safe internal temperature of meat and poultry over two inches thick (160° F or higher for beef and pork, 180° F or higher for poultry. Also see Appendix for Safe Food Book, p. 11 chart on cooking) | 1 2 3 4 5 9 | DO NOT RATE |

1=No microbiological risk if behavior NOT performed, 2=Small degree, 3=Moderate degree, 4=High degree, 5=Very high degree, 9=Unable to rate degree of microbiological risk.

FOOD HANDLING BEHAVIOR

Extent of Microbiological Risk If
Behavior NOT Performed

A. Raw or Partially
Cooked Meat &
Poultry

B. Fully Cooked
Meat & Poultry

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Control Zone 8 - Initial Cooking by Consumer

[Cook]

[Reheat]

- | | | | | | | | | | | | | | | | | | | |
|--|---|---|---|---|---|---|--|--|--|--|--|---|---|---|---|---|---|-------------|
| 12. Use recipe, internal meat or juice color to determine doneness of meat and poultry two inches or less in thickness. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | | | | | | | DO NOT RATE |
| 13. Use rotating microwave pad (or similar energy dispersion device) if microwaving. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | 1 | 2 | 3 | 4 | 5 | 9 | |
| 14. Use microwave temperature probe if microwaving. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | 1 | 2 | 3 | 4 | 5 | 9 | |
| 15. Based on microwave cooking directions, increase microwaving time if necessary for product to reach safe temperature. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | 1 | 2 | 3 | 4 | 5 | 9 | |
| 16. Let microwaved food stand for recommended number of minutes before serving. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | 1 | 2 | 3 | 4 | 5 | 9 | |
| 17. Use crockpots, smokers, or slow cookers according to label directions. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | 1 | 2 | 3 | 4 | 5 | 9 | |
| 18. Avoid tasting foods in process. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | 1 | 2 | 3 | 4 | 5 | 9 | |
| 19. Avoid interrupted cooking. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | 1 | 2 | 3 | 4 | 5 | 9 | |
| 20. Avoid contact of raw juices with hands, equipment, environment, or with any other food--raw or cooked. | 1 | 2 | 3 | 4 | 5 | 9 | | | | | | 1 | 2 | 3 | 4 | 5 | 9 | |

PROCESS 4: SERVING MEAT AND POULTRY

Control Zone 9 - Room Temperature Holding

- | | | | | | | | | | | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-------------|
| 1. Wash hands with soap and water for 20 seconds before serving cooked food. | | | | | | | | | | | | | | | | | | DO NOT RATE |
| 2. Serve cooked products on clean plates and with clean utensils and clean hands. | | | | | | | | | | | | | | | | | | DO NOT RATE |

1=No microbiological risk if behavior NOT performed, 2=Small degree, 3=Moderate degree, 4=High degree, 5=Very high degree, 9=Unable to rate degree of microbiological risk.

A. Raw or Partially
Cooked Meat &
PoultryB. Fully Cooked
Meat & Poultry

PROCESS 4: SERVING MEAT AND POULTRYControl Zone 9 - Room Temperature Holding

3. In environmental temperatures 90°F or above, leave out cooked food no longer than one hour before refrigerating, re-freezing or reheating.

DO NOT RATE 1 2 3 4 5 9

4. In environmental temperatures below 90°F, leave out cooked food no longer than two hours before refrigerating, freezing or reheating.

DO NOT RATE 1 2 3 4 5 9

Control Zone 10 - Hot Holding

5. Hold hot food above 140°F.

DO NOT RATE 1 2 3 4 5 9

Control Zone 11 - Eating

6. Wash hands with soap and water for 20 seconds before eating cooked foods.

DO NOT RATE 1 2 3 4 5 9

7. Avoid dipping personal spoon in serving dish.

DO NOT RATE 1 2 3 4 5 9

PROCESS 5: HANDLING LEFTOVERSControl Zone 12 - Sanitation

1. Wash hands with soap and water for 20 seconds before handling leftovers.

DO NOT RATE 1 2 3 4 5 9

2. Use clean surfaces and utensils.

DO NOT RATE 1 2 3 4 5 9

3. Remove stuffing before cooling or freezing.

DO NOT RATE 1 2 3 4 5 9

Control Zone 13 - Cold Storage

4. Refrigerate or freeze cooked leftovers in small, covered, shallow containers within two hours after cooking.

DO NOT RATE 1 2 3 4 5 9

1=No microbiological risk if behavior NOT performed, 2=Small degree, 3=Moderate degree, 4=High degree, 5=Very high degree, 9=Unable to rate degree of microbiological risk.

FOOD HANDLING BEHAVIOR

Extent of Microbiological Risk If
Behavior **NOT** Performed

A. Raw or Partially
Cooked Meat &
Poultry

B. Fully Cooked
Meat & Poultry

PROCESS 5: HANDLING LEFTOVERS

Control Zone 13 - Cold Storage

- | | | | | | | | |
|--|-------------|---|---|---|---|---|---|
| 5. Leave airspace around packaged leftovers in refrigerator or freezer. | DO NOT RATE | 1 | 2 | 3 | 4 | 5 | 9 |
| 6. Date leftovers to allow use within safe time period (see Appendix for Safe Food Book, p. 14 chart on Cold Storage). | DO NOT RATE | 1 | 2 | 3 | 4 | 5 | 9 |
| 7. Avoid refreezing leftovers that have been frozen, thawed and reheated. | DO NOT RATE | 1 | 2 | 3 | 4 | 5 | 9 |
| 8. Avoid tasting old leftovers to determine food safety. | DO NOT RATE | 1 | 2 | 3 | 4 | 5 | 9 |

Control Zone 14 - Reheating Cooked Leftovers

- | | | | | | | | |
|---|-------------|---|---|---|---|---|---|
| 9. Cover and reheat leftovers to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, "wet" foods; 165°F for all others). | DO NOT RATE | 1 | 2 | 3 | 4 | 5 | 9 |
|---|-------------|---|---|---|---|---|---|

Control Zone 15 - Disposal

- | | | | | | | | |
|---|-------------|---|---|---|---|---|---|
| 10. Discard leftovers that have been chilled and reheated more than twice. | DO NOT RATE | 1 | 2 | 3 | 4 | 5 | 9 |
| 11. Discard unsafe leftovers in garbage disposal or in tightly wrapped packages that cannot be consumed by people or animals. | DO NOT RATE | 1 | 2 | 3 | 4 | 5 | 9 |
| 12. If in doubt, discard leftovers as in item 11 above. | DO NOT RATE | 1 | 2 | 3 | 4 | 5 | 9 |

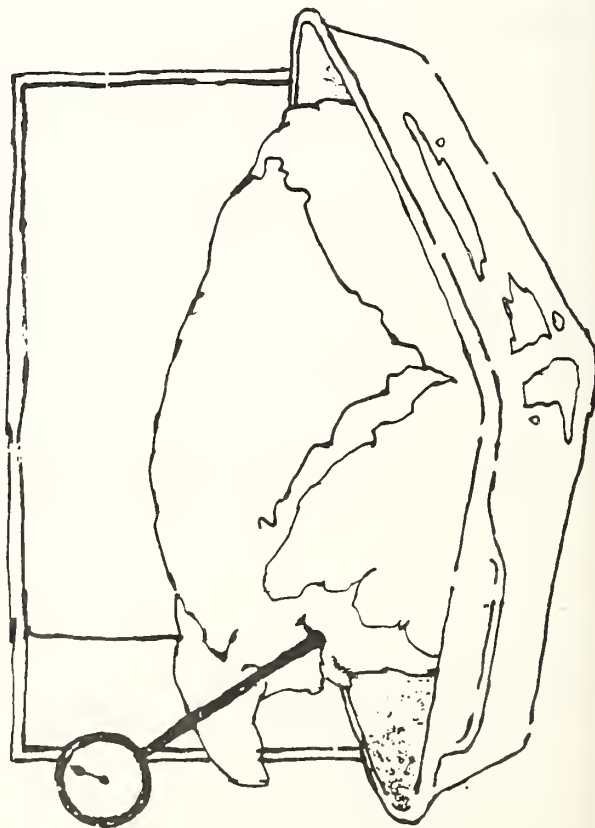
1=No microbiological risk if behavior **NOT** performed, 2=Small degree, 3=Moderate degree, 4=High degree, 5=Very high degree, 9=Unable to rate degree of microbiological risk.

Cooking Meat & Poultry

Meat and poultry cooked throughout to these temperatures are generally safe to eat. For microwave cooking, see special instructions, page 16.

FRESH BEEF		Celsius	Fahrenheit	CURED PORK	
Rare		60	140*	Ham, Raw	
Medium		71	160	(Cook before eating)	77
Well Done		77	170	Ham, Fully cooked	170
Ground Beef		77	170		
FRESH VEAL		77	170	(Heat before serving)	
FRESH LAMB				Shoulder	60
Medium		77	170	(Cook before eating)	170
Well Done		82	180		
FRESH PORK		77	170		
POULTRY				GAME	
Chicken		82-85	180-185	Deer	71-77
Turkey		82-85	180-185	Rabbit	160-170
Boneless				Duck	82-85
Turkey Roasts		77-80	170-175	Goose	180-185
Stuffing					82-85
(Inside or outside the bird)		74	165		180-185

* Rare beef is popular, but you should know that cooking it to only 140°F means some food poisoning organisms may survive.



Cold Storage of Meat and Poultry

TIME LIMITS? Because you can't tell exactly how long meat and poultry will last when you get them home, this chart gives short, conservative storage times. You may be used to keeping food longer, but following the chart will help protect you from food spoilage—what you risk with long refrigeration—and from taste loss—what happens when food is left too long in the freezer.

Product	Refrigerator (Days at 40°F)	Freezer (Months at 0°F)
FRESH MEATS		
Roasts (beef)	3 to 5	6 to 12
Roasts (lamb)	3 to 5	6 to 9
Roasts (pork, veal)	3 to 5	4 to 8
Steaks (beef)	3 to 5	6 to 12
Chops (lamb)	3 to 5	6 to 9
Chops (pork)	3 to 5	3 to 4
Hamburger, ground and stew meats	1 to 2	3 to 4
Variety meats (tongue, brain, kidneys, liver, and heart)	1 to 2	3 to 4
Sausage (pork)	1 to 2	1 to 2
COOKED MEATS		
Cooked meat and meat dishes	3 to 4	2 to 3
Gravy and meat broth	1 to 2	2 to 3
PROCESSED MEATS (Frozen, cured meat loses quality rapidly and should be used as soon as possible.)		
Bacon	7	1
Frankfurters	7*	1 to 2
Ham (whole)	7	1 to 2
Ham (half)	3 to 5	1 to 2
Ham (slices)	3 to 4	1 to 2
Luncheon meats	3 to 5*	1 to 2
Sausage (smoked)	7	1 to 2
Sausage (dry, semi-dry)	14 to 21	1 to 2
FRESH POULTRY		
Chicken and turkey (whole)	1 to 2	12
Chicken pieces	1 to 2	9
Turkey pieces	1 to 2	6
Duck and goose (whole)	1 to 2	6
Giblets	1 to 2	3 to 4
COOKED POULTRY		
Covered with broth, gravy	1 to 2	6
Pieces not in broth or gravy	3 to 4	1
Cooked poultry dishes	3 to 4	4 to 6
Fried chicken	3 to 4	4
GAME		
Deer	3 to 5	6 to 12
Rabbit	1 to 2	12
Duck and goose (whole, wild)	1 to 2	6

* Once a vacuum-sealed package is opened. Unopened vacuum-sealed packages can be stored in the refrigerator for 2 weeks.

SECTION B

PLEASE TELL US ABOUT YOURSELF

1. How many years of experience do you have as a microbiologist?

_____ years

2. How many years of experience do you have as a food microbiologist?

_____ years

3. For how many years have you worked:

a. In industry _____

b. In government _____

c. In colleges/universities _____

d. In other settings _____

4. What is your highest degree? (Circle the number that best fits)

1 Bachelor's degree

2 Master's degree

3 Doctoral degree

4 Postdoctoral training

5 Other (please specify) _____

SECTION C

YOUR VIEWS ON FOOD SAFETY EDUCATION

1. Are there additional meat and poultry handling behaviors that are important in preventing bacterial or parasitic foodborne illness, but which were not included in the inventory?

Yes ____

No ____

If YES, insert the behavior in the inventory (in the space you consider best), and rate the microbiological risk for each of the two product categories (if relevant).

2. Do you believe that cooking and handling information on food labels (care labeling) would positively influence consumer behavior, thereby reducing contamination levels at the time of consumption?

Yes ____

No ____

3. If YES, for which of the following **MEAT AND POULTRY** product categories do you think care labeling would be most useful? (CIRCLE ALL NUMBERS THAT APPLY)

- 1 Raw products in general
- 2 Raw, ground products
- 3 Raw cuts less than 2 inches thick
- 4 Raw cuts 2 inches thick or greater
- 5 Raw cuts in vacuum or mixed-atmosphere packaging
- 6 Dried breaded, marinated, stuffed or other semi-prepared (non-heat-processed) raw products
- 7 Partially cooked products in general
- 8 Partially cooked products that are refrigerated at time of purchase
- 9 Partially cooked products that are frozen at time of purchase
- 10 Partially cooked products in vacuum or mixed-atmosphere packaging
- 11 Fully cooked products that are shelf-stable at the time of purchase
- 12 Fully cooked products that are hot at time of purchase
- 13 Fully cooked products that are refrigerated at time of purchase
- 14 Fully cooked products that are frozen at time of purchase
- 15 Fully cooked products in vacuum or mixed-atmosphere packaging
- 16 Mail order products
- 17 Other products (please specify) _____

4. What do you think will be the greatest microbiological food safety concerns over the next five years? (CIRCLE ALL NUMBERS THAT APPLY)

- 1 Salmonella in general
- 2 Campylobacter jejuni
- 3 E coli 0157:H7
- 4 Listeria monocytogenes
- 5 Products in vacuum, mixed-atmosphere or other novel packaging
- 6 Shelf-stable products in general
- 7 Refrigerated products in general
- 8 Frozen products in general
- 9 Partially cooked products in general
- 10 Raw products in general
- 11 Products that are hot (whether partially or fully cooked) at time of purchase
- 12 Training of commercial food handlers
- 13 Education of home food handlers
- 14 Other (please specify) _____

Please make any additional comments below.

THANK YOU AGAIN FOR YOUR TIME AND INPUT



United States
Department of
Agriculture

Food Safety
and Inspection
Service

Washington, D.C.
20250

**APPENDIX B: Letter Sent to Members of the
National Advisory Committee on Microbiological Criteria for Foods**

To: Members of the National Advisory Committee on Microbiological Criteria for Foods October 25, 1988

From: Patricia Drayne, Deputy Director *Patricia Drayne*
Information and Legislative Affairs

Subject: Questionnaire for Microbiologists

As promised, here is your copy of the survey sent to 11 microbiologists as part of the effort to identify critical control points for consumers in their home kitchens.

We would very much appreciate receiving your own rating of the 123 safe-handling behaviors listed on pages 4-11. In addition, your comments on the following would be particularly useful:

1. The wording of the behavior statements.
2. The charts on page 11A. (They are from the Safe Food Book, and will be revised as necessary along with the rest of that publication.)

Your rating and comments will be welcome at any time, but will be most useful to us if received by November 18. Please address them to:

Ms. Sharin Sachs
Chair, HACCP Task Force
USDA-FSIS-ILA
Room 1160-South Bldg.
Washington, D.C. 20250

Thank you for your help. I enjoyed the opportunity to speak to you in Orlando, and was especially pleased at the committee's interest in our HACCP project and in our other consumer education activities.

cc: J. Adams
S. Sachs
C. Deroever

**APPENDIX C: Letter Sent to Selected Consumer Experts
(First page of questionnaire immediately follows sample letter)**

Dear:

Thank you for agreeing to complete the U.S. Department of Agriculture questionnaire on consumers' knowledge and practice of various food handling activities. The questionnaire has been pretested with others knowledgeable in consumer behavior like yourself, to make it as valid and easy to complete as possible. I believe that it will require approximately one hour of your time.

Please return the questionnaire within the next two weeks in the addressed, franked envelope which has been enclosed. If you have questions, please feel free to contact me at (202) 447-9351.

Once again, thank you for taking time out of your busy schedule to help us with this project. Your efforts will insure that the Food Safety and Inspection Service will plan appropriate food safety education materials in the months ahead.

Sincerely,

Marjorie L. Davidson

QUESTIONNAIRE

ASSESSING CONSUMER'S FOOD HANDLING PRACTICES AND KNOWLEDGE

Name: _____

Organization: _____

Date: _____

BACKGROUND:

The Information and Legislative Affairs Division for the Food Safety and Inspection Service has formed a working group to determine future priorities in food safety consumer education, using a Hazard Analysis Critical Control Points (HACCP) approach. The working group, which includes technical experts from other FSIS programs, has developed an inventory of meat and poultry handling behaviors under the direct control of the home food handler. The inventory includes those behaviors known or believed to help prevent bacterial or parasitic foodborne diseases. This questionnaire asks you to assess the extent to which the home food handler knows about and practices each behavior. The working group will also examine epidemiological and microbiological data.

Your work on this questionnaire will help FSIS to revise a major consumer education publication, the "Safe Food Book." It will also help to ensure that FSIS educational programs target the food handling behaviors that are (1) most important in preventing foodborne illness and (2) least understood or practiced. Findings will be statistically tabulated and summarized; individuals will not be associated with particular answers.

The questionnaire includes three sections: (1) the inventory of food handling behaviors whose importance you are asked to assess; (2) a request for information about your education, training and experience in this area; and (3) your views on certain food safety education issues.

Please be as thorough and specific as possible; FSIS values your comments.

APPENDIX D: Survey of Surveys

INTRODUCTION

The enclosed package consolidates material from six surveys (identified in all materials by the capital letters A - F) of consumers' food handling practices and knowledge. These surveys were reviewed and all information relevant to items in the questionnaire, Meat and Poultry Product Handling Behaviors Inventory (MPPHBI) was extracted.

The information is presented in the following materials in a format designed to accomodate the needs of the ILA HACCP Task Force Public Awareness Subcommittee. The Subcommittee will use this information to help determine the points of food handling behavior and consumer knowledge that present the most risk to the population. Other public awareness information will be provided by the ratings of the nine consumer experts.

The package includes the following documents:

1. Six charts and six tables describing each of the surveys from which relevant information was drawn.
2. The MPPHBI with the relevant information from the six surveys inserted.
3. A set of 14 tables that displays the percentage of subgroups (categories of age, education, income, etc.) who had incorrect knowledge or who used risky practices, as indicated by the six surveys.

DESCRIPTION OF THE METHODS AND SAMPLES OF THE SURVEYS

The following section describes the six surveys from which information has been collected for insertion into the MPPHBI. For each survey, a chart describes the method used for the survey, followed by a table which describes the sample used in the survey.

For the charts, basic descriptive data are presented. Then, the sampling plan, data collection method, and precision of the information are briefly described. Finally, the strengths and weaknesses of each survey are listed.

For the tables, only the information that appeared in published reports was used. The specific demographic characteristics (age, education, income, etc.) as well as the categories of the characteristics (for example, age groupings) displayed for each survey may differ due to the information available in the respective reports. Therefore, the information from the various surveys may not be directly comparable. For each survey, all available information about the sample was included.

Chart 1. Method of Survey A.

Survey topic: Salmonella, food poisoning

Organization: The Gallup Organization

Data collection date: April 1973

Area sampled: United States, including Alaska and Hawaii

Sample size: 816

Respondents: Women over 18 years

Sampling plan: Most likely a type of probability sample.
Correction was made for hard-to-reach people by a
"times-at-home" technique.

Data collection method: In-person interviews

Precision of information for total sample: Plus or minus 4
percentage points. The confidence intervals (precision of
information) for subgroups are wider and depend on the
number of respondents in the subgroup).

Strengths:

- *Nationally representative sample
- *Adequate sample size
- *Some adjustment for non-response bias
- *Experienced survey organization

Weaknesses:

- *Data are 15 years old
- *All questions were technically worded; may have underestimated respondents' knowledge
- *The open-ended format of some questions may have produced underestimates of respondents' knowledge

Table 1. Sample Composition for Survey A.
Gallup (1974)

All Women	<u>Percent</u> 100
<u>Age</u>	
18 to 34 years	37
35 to 49 years	27
50 years and older	35
Undesignated	1
	<hr/> 100
<u>Education</u>	
Grade School	18
High School Incomplete	19
High School Graduate	41
College	22
Undesignated	1
	<hr/> 100
<u>Family Income</u>	
Under \$7,000	37
\$7,000 to \$9,999	15
\$10,000 to 14,999	25
\$15,000 and over	19
Undesignated	4
	<hr/> 100
<u>Size of Community</u>	
1,000,000 and over, including urban fringe	18
250,000 to 999,999, including urban fringe	21
50,000 to 249,999, including urban fringe	17
2,500 to 49,999	17
Under 2,500	27
	<hr/> 100

Number = 816

Chart 2. Method of Survey B.

Survey title: Food Safety: Homemakers' Attitudes and Practices

Organization: Economic Research Service, USDA (Jones and Weiner)

Data collection date: Summer, 1974

Area sampled: United States, excluding Alaska and Hawaii

Sample size: 2197 weighted for non-response to 2503

Respondents: Homemakers (people having major responsibility for decisions on purchasing and preparing food for household use)

Sampling plan: Stratified area probability design which gave each household an equal and known probability of being selected into the sample. No substitutions if the repeat visit procedure resulted in no interview.

Data collection method: In-person interviews

Precision of information for total sample: Plus or minus 3 percentage points. The confidence intervals (precision of information) for subgroups are wider and depend on the number of respondents in the subgroup.

Strengths:

- *Nationally representative sample
- *Large sample size
- *Adjustment for non-response
- *Questions appropriately worded for respondents
- *Conducted according to high professional standards

Weakness:

- *Data are 14 years old

Table 2. Sample Composition of Survey B.
ERS/USDA, Jones and Weiner (1974)

<u>Age</u>	<u>Percent</u>
Under 30	22
30 to 49	38
50 to 64	25
65 and over	15
	<hr/> 100
<u>Education</u>	
Grade School or less	17
Some High School	19
High School Graduate	40
Any College	23
	<hr/> 100
<u>Family Income</u>	
under \$3,000	10
\$5,000 to \$5,999	15
\$6,000 to \$9,000	20
\$10,000 to \$14,999	28
\$15,000 and over	24
	<hr/> 100
<u>Community Size</u>	
Metro areas-1 million and over	36
Other metro	29
Non-metro	35
	<hr/> 100
<u>Region</u>	
Northeast	26
North Central	27
South	29
West	18
	<hr/> 100

Weighted Number =2,503

Table 3. Sample Composition for Survey C.
Oregon State University, Woodburn (1983)

<u>Age</u>	<u>Percent</u>
20 or less	0
21 to 30	23
31 to 50	39
51 to 70	31
70 or above	7
	<hr/> 100

<u>Education</u>	
Some High School or Less	10
High School Grad or GED	31
Technical or Vocational School	5
Some College	27
College degree or higher	27
	<hr/> 100

<u>Household Income</u>	
Less Than \$10,000	14
\$10,001 to 19,000	24
\$19,001 to \$29,000	27
Above \$29,001	30
DK/NA	5
	<hr/> 100

<u>Sex</u>	
Male	10
Female	90
	<hr/> 100

Number=100

Chart 3. Method of Survey C.

Survey topic: Food handling practices

Organization: Oregon State University, Department of Foods and Nutrition (Woodburn)

Data collection date: March, 1983

Area sampled: Portland, Oregon (metropolitan area) and Yamhill County, Oregon (rural area)

Sample size: 100

Respondents: Adults who do most of the food preparation

Sampling plan: Area probability sampling plan. Substitution was made after two unsuccessful repeat visits.

Data collection method: In-person interviews

Precision of information for total sample: Ranges from plus or minus 6 percentage points for extreme percentages (for example, 10 or 90 percent) to plus or minus 10 percentage points for middle percentages (50 percent).

Strengths:

- *Relatively recent data
- *Non-response bias is probably low since three attempts were made to reach each person
- *Questions appropriately worded for respondents

Weaknesses:

- *Only part of one state represented
- *Small sample size

Chart 4. Method of Survey D.

Survey title: Kansas Food Safety Survey

Organization: Kansas State University, Extension Home
Economics (Kramer)

Data collection date: July, 1983

Area sampled: 8 counties in Kansas

Sample size: 403 of 1100 mailed questionnaires (36 percent
return rate)

Respondents: Adults over 19 years

Sampling plan: Combination of: a- selection of counties
according to population density and male/female
representation, and b- simple and systematic random
selection of households, in three steps.

Data collection method: Mail questionnaire

Precision of information for total sample: Plus or minus 5
percentage points. The confidence intervals (precision of
information) for subgroups are wider and depend on the
number of respondents in the subgroup.

Strengths:

- *Adequate sample size
- *Relatively recent data
- *Questions appropriately worded for respondents
- *Conducted according to high professional standards

Weaknesses:

- *Only one state represented
- *Non-response bias probably large because of low return
rate (analysis to estimate the extent of non-response bias
indicated that respondents had higher educational and income
levels than the general Kansas population, and thus that
results have some bias)

Table 4. Sample Composition for Survey D.
Kansas State University, Kramer (1983)

<u>Age of Respondent</u>	<u>Percent</u>
18 or younger	0
19 to 28	12
29 to 37	20
38 to 55	32
56 or older	36
	<hr/> 100
 <u>Education</u>	
Grade School or Some High School	7
High School graduate	25
Vocational School or Some College	32
College graduate	21
Advance degree work	14
Undesignated	1
	<hr/> 100
 <u>Household Income</u>	
Less than \$5,000	3
\$5,000 to \$ 9,999	8
\$10,000 to \$14,999	11
\$15,000 to \$24,999	25
\$25,000 to \$39,999	26
\$40,000 or more	22
Undesignated	5
	<hr/> 100
 <u>Sex</u>	
Male	41
Female	59
	<hr/> 100
 <u>Employment Outside the Home</u>	
Yes (full-time)	52
Yes (part-time)	11
No	37
	<hr/> 100.0

Table 4 (continued). Sample Composition for Survey D.
 Kansas State University, Kramer (1983)

<u>Number of Children under 5 years</u>	<u>Percent</u>
0	86
1	7
2	6
3	1
4 or more	0
	<hr/> 100

Number = 403

Chart 5. Method of Survey E.

Survey title: Health and Diet Survey Cycle IV

Organization: FDA/FSIS-USDA

Data collection date: June 1988

Area sampled: United States, excluding Alaska and Hawaii

Sample size: 3202

Respondents: Non-vegetarian adults over 18 years

Sampling plan: Random digit dialing. No substitution after 7 call backs.

Data collection method: Telephone interviews

Precision of information for the total sample: Plus or minus 2 percentage points or less.

Strengths:

- *Nationally representative sample
- *Large sample size
- *Current data
- *Conducted according to high professional standards

Weakness:

- *Sample excludes those with no residential telephone

Table 5. Sample Composition of Survey E.
USDA/FDA 1988

<u>Age of Respondent</u>	<u>Percent</u>
25 or younger	11
25 to 34	23
35 to 44	23
45 t 54	14
55 to 64	13
65 and older	16
	<hr/> 100
<u>Education</u>	
Grade School or Some High School	14
High School Graduate	34
More than High School	52
	<hr/> 100
<u>Household Income</u>	
Less than \$5,000	4
\$5,000 to \$10,000	7
\$10,000 to \$15,000	8
\$15,000 to \$20,000	8
\$20,000 to \$25,000	10
\$25,000 to \$35,000	15
\$35,000 to \$50,000	15
More than \$50,000	14
Undesignated	19
	<hr/> 100
<u>Sex</u>	
Male	35
Female	65
	<hr/> 100
<u>Number of Children under 5 years</u>	
0	81
1	13
2	5
3 or more	1
	<hr/> 100

Table 5. Sample Composition of Survey E.
USDA/FDA 1988

<u>Adults Aged 60 or Older</u>	<u>Percent</u>
0	74
1	11
2	14
3 or more	1
	<hr/> 100

Chart 6. Method of Survey F.

Survey title: Trends Consumer Attitudes and the Supermarket
1987

Organization: Food Marketing Institute

Data collection date: January, 1987

Area sampled: United States

Sample size: 1007

Respondents: Male and female heads of households

Sampling plan: Not given. Report states that it is
representative.

Data collection method: Telephone interviews

Precision of information for total sample (assuming a
probability sampling design): Plus or minus 3 percentage
points

Strengths:

- *Nationally representative sample
- *Large sample size
- *Recent data

Weaknesses:

- *Not enough information provided to evaluate method

Table 6. Sample Composition for Survey F.
Food Marketing Institute Trends 1987

<u>Age</u>	<u>Percent</u>
18 to 24	9
25 to 39	39
40 to 49	18
50 to 64	21
65 or older	12
Undesignated	1
	<hr/> 100
 <u>Region</u>	
East	25
Midwest	25
South	30
West	20
	<hr/> 100
 <u>Sex</u>	
Male	39
Female	61
	<hr/> 100
 <u>Children</u>	
With children	50
No children	50
	<hr/> 100

Number = 1007

POPULATION ESTIMATES OF FOOD POISONING RISK

The following section consists of the MPPHBI with risk estimates from the six surveys inserted under the relevant food handling behaviors. For ease of reading, the material added to the inventory is printed in bold.

Each entry first lists the item from the survey.* Next is the percentage of the total sample at risk; that is, the percentage who had wrong knowledge or who used a risky practice. The percentage is listed in one of two columns, knowledge or practice. The items for which the survey reports gave a breakdown by respondent characteristics have a table reference. The breakdown tables are in the next section.

Each inserted entry includes a reference to the survey from which it was drawn. In many instances, the survey response percentages required recalculation to make them as comparable as possible. All percentages refer to the population as a whole (not to a subgroup, such as respondents who had prepared turkey in the past month). Further recalculations were also necessary because missing data were handled differently in the various surveys; the recalculations adjusted for missing data in a consistent way.

*Year of survey in parentheses. Unless otherwise noted, survey is nationwide.

MEAT AND POULTRY PRODUCT HANDLING BEHAVIORS INVENTORY

FOOD HANDLING BEHAVIOR

Extent of Consumer's Knowledge or Practice

A. Knowledge

B. Practice

PROCESS 1: ACQUISITION

Survey Responses Percent At Risk

Control Zone 1 - Planning Food Acquisition

1. Plan use of food before purchase.
2. Plan to buy from reputable source with no record of unsafe handling.
3. Check to see that home storage is adequate for items to be purchased.
4. Consider outside temperature in planning trip.
5. Plan to shop for food last.

Control Zone 2 - Obtaining Food

Believe that USDA inspects for salmonella.
(Survey A)

39 (1973)

Could not correctly identify salmonella.
(Survey A) See Table 1.

74 (1973)

6. Buy packaged meat and poultry only if packaging is sound (examples: undented cans, refrigerated/frozen products without tears in packaging).

Believe that food in bulging cans is safe to eat. (Survey B, p. 121)

4 (1974)

Do not usually check packaging on foods before buying. (Survey F, p. 31)

2 (1987)

A. Knowledge

B. Practice

PROCESS 1: ACQUISITION

Survey ResponsesPercent At RiskControl Zone 2 - Obtaining Food

7. Buy products labeled "keep refrigerated" only if they are stored in a refrigerated meat case.
8. Buy frozen products only if they appear frozen solid to the touch.
9. Buy products from deli refrigerated display cases only if unpackaged products are not in contact with other unpackaged raw or cooked products.
10. Buy "open dated" products only if label sell-by, use-by, or pull-by date has not expired.

Do not usually check dates on dated foods (Survey F, p. 31)

7 (1987)

11. Place meat, poultry, cold foods in shopping cart last.
12. Place meat and poultry packages in individual plastic bags.
13. Report problems with packaging, product, storage, sanitation to store management or, if unsatisfied, to local health authorities.

Control Zone 3 -- Transporting Meat and Poultry

14. In climate temperatures 70°F or below, hold cold foods at 40°F in vehicle or plan to place in cold storage within one hour.
15. Hold hot foods above 140°F in vehicle, OR plan to reheat or place in cold storage within two hours.
16. If climate temperature is above 70°F or distance is more than 30 miles, use ice chest for cold items.

Process 2: HOME STORAGE OF MEAT AND POULTRY

Survey Responses
Percent At RiskControl Zone 4 - Refrigeration

1. Use plastic bags, aluminum foil over commercial packaging or place product on plate to prevent raw juices from dripping on other foods or refrigerator surfaces.
2. Wash hands with soap and water for 20 seconds before re-wrapping products whose packaging was damaged during transport.
3. Use refrigerator thermometer to verify temperature of 40°F or colder.

Refrigerator warmer than 40 degrees
(Survey B, p. 90) See Table 2.

49 (1974)

4. Refrigerate products with "keep refrigerated" label.
5. Store meat and poultry in back of refrigerator rather than in door.
6. Maintain a clean refrigerator.
7. Refrigerate raw meat and poultry within one hour after removing from meat case.
8. Date undated products so they can be used within a safe time limit that will also assure quality (see Appendix for Safe Food Book, p. 14 chart on Cold Storage).
9. Use dated or undated products within a safe time limit that will also assure quality (see Appendix for Safe Food Book, p. 14 chart on Cold Storage).

Believe that refrigeration stops bacterial growth. (Survey B, p. 129)
See Table 3.

22 (1974)

10. If refrigerator fails, keep door closed and, within six hours, cook products, OR place in environment 40°F or colder.

Process 2: HOME STORAGE OF MEAT AND POULTRY

Survey Responses

Percent At Risk

Control Zone 5 - Freezing

11. Use freezer wrap, aluminum foil, freezer bag or other sound packaging over commercial wrap to prevent juices from contacting other foods or freezer surfaces.
12. Wash hands with soap and water for 20 seconds before re-wrapping product whose packaging was damaged in transport.
13. Use thermometer to verify 0° F freezer temperature or colder.
14. Freeze foods with "keep frozen" label.
15. Freeze raw meat and poultry that will not be used within 2 days.
16. Store meat and poultry in back of freezer, rather than in door.
17. Maintain a clean freezer.
18. Date undated products so they can be used within safe time limits that will also assure quality.
19. Use dated or undated products within safe time limit.
20. If freezer fails, within two days refreeze, cook or discard products.

Believe that freezing will kill any bacteria that may cause food poisoning.
(Survey B, p.123) See Table 4.

20 (1974)

Would refreeze warm meat after freezer failure. (Survey D, p.32)

3 (1983, Ka)

After freezer failure, would use meat that had been warmer than refrigerator temperature for an unknown period of time. (E)

12 (1988)

A. Knowledge

B. Practice

PROCESS 2: HOME STORAGE OF MEAT AND POULTRY

Survey Responses
Percent At RiskControl Zone 6 - Disposal

21. Properly dispose of outdated or other potentially unsafe frozen or refrigerated products in a way that prevents consumption by humans or animals.

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Control Zone 7 - Preliminaries

Places where food safety concerns are likely to occur: home ranked #8, last. (Survey D, p. 11)

(1983, Ka)

1. Wash hands (gloved or not) with soap and water for 20 seconds before beginning preparation, after handling raw meat and poultry, after touching animals, using bathroom, or changing diaper.

Foods ranked according to safety concerns: Meat ranked first; poultry ranked second. (Survey D, p. 11)

Food safety concern: "Disease causing organisms and parasites" ranked #2, almost tied with #1, environmental contaminants. (Survey D, p. 11)

Believe that meat and poultry are not likely to have harmful bacteria. (Survey B, p. 97) See Table 5.

63 (1974)

Believe that meat and poultry do not contain bacteria. (Survey D, p.30) See Table 5.

20 (1983, Ka)

Would not wash knife, cutting board, and hands after handling raw meat and before cutting vegetables for salad. (Survey B, p. 88) See Table 6. (Survey D, p. 31)

60 (1974)

46 (1983, Ka)

Would not wash knife, cutting board, and hands after handling raw chicken and before cutting vegetables for salad. (Survey C, p. 2)

34 (1983, Ore)

A. Knowledge

B. Practice

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Survey ResponsesPercent At RiskControl Zone 7 - Preliminaries

Do not wash hands with soap after handling raw meat or poultry. (E)

2. Dry hands on paper towels or use cloth towel and place in laundry after use.

3. Wear clean plastic glove over skin cuts.

Not concerned that a cut would contaminate meat. (Survey B, p. 108)
See Table 7.

45 (1974)

4. Clean counters, equipment, utensils with soap and water immediately after use.

See Number 1 above.

Did not know that washing minimizes the spread of bacteria (open ended question). (Survey A)

94 (1973)

Would not wash work surface between cutting raw chicken and removing meat from bones. (Survey C, p.1)

9 (1983, Ore)

Would chop giblets for sandwich without washing board that held raw turkey. (Survey C, p. 4)

29 (1983, Ore)

Wiped or rinsed cutting board after cutting raw chicken. (Survey C, p.1)

28 (1983, Ore)

Wiped or rinsed knife after cutting raw chicken. (Survey C, p.1)

27 (1983, Ore)

Would not wash ~~knife~~ cutting board after cutting raw meat or poultry, before cutting vegetables for a salad. (Survey E)

29 (1988)

5. Sneeze away from food.

6. Thaw only in refrigerator, under cold running water, or in microwave (followed by immediate cooking).

A. Knowledge

B. Practice

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Survey Responses
Percent At RiskControl Zone 7 - Preliminaries

Not concerned about raw meat or poultry standing at room temperature for 2 to 3 hours. (Survey B, p. 130) See Table 8.

12 (1974)

Do not know that bacteria grow rapidly at room temperature. (Survey B, p. 125) See Table 8.

9 (1974)

Would thaw turkey at room temperature (Survey C, p. 13)

27 (1983, Ore)

Usually thaws meat and poultry at room temperature for more than 2 hours. (Survey E)

23 (1988)

7. Marinate raw product in refrigerator.

8. Stuff raw product immediately before cooking.

Do not know to stuff poultry just before roasting. (Survey B, p.124) See Table 9.

11 (1974)

Stuffed turkey a day or more in advance (Survey B, p. 57)

2 (1974)

9. Avoid tasting raw product.

Control Zone 8 - Initial Cooking by Consumer

10. Cook products immediately after thawing.

11. Use meat thermometer to judge safe internal temperature of meat and poultry over two inches thick.

Do not use meat thermometer for pork roast (Survey B, p. 45)

99.6 (1974)

Do not use meat thermometer for turkey (Survey B, p. 61)

48 (1974)

~~Never~~
~~Do not~~ use meat thermometer or pop-up timer for turkey. (E) (Survey C, p. 13)

44 (1988)

A. Knowledge

B. Practice

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Survey Responses

Percent At Risk

Control Zone 8 - Initial Cooking by Consumer

Do not use meat thermometer or pop-out timer for whole chickens. (E)

(_____, 1988)

Do not use meat thermometer for roast beef. (E)

86 (1988)

Serve pork rare. (E)
(Survey B, p. 44)

0 (1988)

0 (1974)

Serve chicken rare or medium rare. (E)

0 (1988)

12. Use recipe, internal meat or juice color to determine doneness of meat and poultry two inches or less in thickness.

Serve ground beef rare or medium rare
(Survey B, p. 32) See Table 10.

14 (1974)

Serve hamburgers rare. (E)
or medium rare.

25 (1988)

Serve steak rare. (E)

8 (1988)

Use unsafe methods to decide the doneness of hamburgers. (E)

(_____, 1988)

13. Use rotating microwave pad (or similar energy dispersion device) if microwaving.
14. Use microwave temperature probe if microwaving.
15. Based on microwave cooking directions, increase microwaving time if necessary for product to reach safe temperature.
16. Let microwaved food stand for recommended number of minutes before serving.

A. Knowledge

B. Practice

PROCESS 3: PREPARATION OF MEAT AND POULTRY

Survey Responses
Percent At RiskControl Zone 8 - Initial Cooking by Consumer

17. Use crockpots, smokers, or slow cookers according to label directions.
18. Avoid tasting foods in process.
19. Avoid interrupted cooking.

Interrupted turkey (Survey B, p. 60)

2 (1974)

20. Avoid contact of raw juices with hands, equipment, environment, or with any other food--raw or cooked.

Believe that the juices of raw meat and poultry are germ free. (E)

6 (1988)

PROCESS 4: SERVING MEAT AND POULTRY

Control Zone 9 - Room Temperature Holding

1. Wash hands with soap and water for 20 seconds before serving cooked food.
2. Serve cooked products on clean plates and with clean utensils and clean hands.
3. In environmental temperatures 90°F or above, leave out cooked food no longer than one hour before refrigerating, re-freezing or reheating.
4. In environmental temperatures below 90°F, leave out cooked food no longer than two hours before refrigerating, freezing or reheating.

Would hold at room temperature over three hours (Survey C, p. 6):

Sliced roast beef
Chicken sandwich
Beef pot pie

24
13
10 } (1983, Ore)

Believe that the maximum time a turkey can safely remain at room temperature is over 2 hours. (Survey C, p. 13)

58 (1983, Ore)

A. Knowledge

B. Practice

Control Zone 9 - Room Temperature Holding

	<u>Survey Responses</u> Percent At Risk	
Believe that food should be left to cool at room temperature before refrigerating. (Survey B, p. 126) See Table 11.	66	(1974)
Not concerned about cooked meat and poultry standing at room temperature for 2 to 3 hours. (Survey B, p. 133) See Table 11.	46	(1974)
Believe that ^{cooked} meat or chicken left at room temperature overnight is safe to eat. (E)	26	(1988)
Cool most foods to room temperature before refrigerating. (Survey C, p. 20)		50 (1983, Ore)
Would cool a pot pie to room temperature before refrigerating. (Survey C, p. 16)		22 (1983, Ore)
Would let fried chicken reach room temperature before refrigerating. (Survey D, p. 31)		32 (1983, Ka)
Would leave meatloaf at room temperature for several hours. (Survey D, p. 31)		2 (1983, Ka)
Held cooked chicken at room temperature over 2 hours. (Survey B, p. 80)		12 (1974)
Held cooked turkey at room temperature over 2 hours. (Survey B, p. 69) See Table 12.		22 (1974)
Held roast beef at room temperature over 2 hours. (Survey B, p. 40) See Table 12.		13 (1974)
Held roast pork at room temperature over 2 hours. (Survey B, p. 51) See Table 12.		7 (1974)
Held meat salad at room temperature over 2 hours. (Survey B, p. 7) See Table 12.		29 (1974)
Would hold turkey at room temperature for 6 hours. (Survey C, p. 3)		26 (1983, Ore)
Would hold ham at room temperature for 6 hours. (Survey C, p. 3)		33 (1983, Ore)

A. Knowledge

B. Practice

Control Zone 9 - Room Temperature HoldingSurvey Responses

Percent At Risk

Would hold bbq beef at room temperature for 6 hours. (Survey C, p. 3)

22 (1983, Or

Would not avoid taking on a picnic to eat 3 hours later, with no way to keep it cold:
(Survey B, p. 89)

Chicken or tuna salad

26 (1974)

Luncheon meats

33

Baked ham

67

Roast beef

67

Fried Chicken

73

Control Zone 10 - Hot Holding

5. Hold hot food above 140°F.

Control Zone 11 - Eating

6. Wash hands with soap and water for 20 seconds before eating cooked foods.

7. Avoid dipping personal spoon in serving dish.

PROCESS 5: HANDLING LEFTOVERS

Control Zone 12 - Sanitation

1. Wash hands with soap and water for 20 seconds before handling leftovers.

2. Use clean surfaces and utensils.

3. Remove stuffing before cooling or freezing.

Believe that it is safe to store stuffing in turkey. (Survey B, p. 128) See Table 13. 32 (1974)

Stored stuffing in turkey. (B, p. 72) 3 (1974)

A. Knowledge

B. Practice

PROCESS 5: HANDLING LEFTOVERS

Survey ResponsesPercent At RiskControl Zone 13 - Cold Storage

4. Refrigerate or freeze cooked leftovers in small, covered, shallow containers within two hours after cooking.

Would cool a large pot of food with meat at room temperature for more than 2 hours before refrigerating. (E)

8 (1988)

Leave leftovers in the cooking pot or in a deep container. (E)

67 (1988)

5. Leave airspace around packaged leftovers in refrigerator or freezer.

6. Date leftovers to allow use within safe time period (see Appendix for Safe Food Book, p. 14 chart on Cold Storage).

7. Avoid refreezing leftovers that have been frozen, thawed and reheated.

8. Avoid tasting old leftovers to determine food safety.

Control Zone 14 - Reheating Cooked Leftovers

9. Cover and reheat leftovers to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, "wet" foods; 165°F for all others).

Heated gravy less hot than simmer.
(Survey B, p. 82) See Table 14.

24 (1974)

Finger test or taste to determine whether a reheated casserole is hot enough.
(Survey C, p. 3)

45 (1983, Ore)

Use unsafe method to determine whether leftovers containing meat are hot enough.
(E)

(1988)

A. Knowledge

B. Practice

Survey ResponsesPercent At RiskControl Zone 15 - Disposal

10. Discard leftovers that have been chilled and reheated more than twice.
11. Discard unsafe leftovers in garbage disposal or in tightly wrapped packages that cannot be consumed by people or animals.
12. If in doubt, discard leftovers as in item 11 above.

SUBGROUP ESTIMATES OF FOOD POISONING RISK

The following section consists of a set of tables that display risk estimates for subgroups. Each table includes a reference to the relevant behavior in the MPPHBI.

These tables were constructed with whatever information was available. Most of the survey reports did not include breakdowns by respondent characteristics, and when they did, only a few characteristics were used. Furthermore, the categories of the various characteristics differed among the surveys as was the case with the sample composition data.

The same type of recalculations done for the total sample to insert percentages into the inventory were done for these tables. The percentages were recalculated to refer to the total subgroup category, and missing data were adjusted for in a consistent way.

KNOWLEDGE

Process 1: Acquisition

Control Zone 2: Obtaining Food

TABLE 1. Ignorance of Salmonella

<u>Education</u>	<u>Could Not Identify Salmonella *</u> (National Survey) Percent
Grade school or less	89
Some high school	82
High school graduate	70
Some college or more	61
Population Estimate	74

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent of respondents who could not correctly identify salmonella (choices given in question). (Survey A)

PRACTICE

Process 2: Home Storage of Meat and Poultry

Control Zone 4: Refrigeration

Step 3: Keep refrigerator at 40°F or colder.

TABLE 2. Refrigerator Too Warm

	Refrigerator Warmer than 40°F *
	(National Survey)
<u>Education</u>	Percent
Grade school or less	53
Some high school	51
High school graduate	48
Any college	45
<u>Family Income</u>	
Under \$3,000	55
\$3,000 to \$5,999	53
\$6,000 to \$9,999	55
\$10,000 to \$14,999	44
\$15,000 and over	44
<u>Region</u>	
Northeast	57
North Central	40
South	50
West	44
Population estimate	49

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Thermometer placed in refrigerator by interviewer and read at the end of the interview. Percent with refrigerator warmer than 40°F. (Survey B, p. 90)

KNOWLEDGE

Process 2: Home Storage of Meat and Poultry

Control Zone 4: Refrigeration

Step 9: Use products within a safe time limit.

TABLE 3. Ignorance of Bacterial Growth
During Refrigeration

<u>Age</u>	Refrigeration stops <u>bacterial growth *</u> (National Survey) Percent
Under 30	18
30 to 49	17
50 to 64	27
65 and over	32
<u>Education</u>	
Grade school or less	32
Some high school	24
High school graduate	22
Any college	13
<u>Family Income</u>	
Under \$3,000	30
\$3,000 to \$5,999	29
\$6,000 to \$9,999	23
\$10,000 to \$14,999	19
\$15,000 and over	16
<u>Community Size</u>	
Metro areas over 1 million	25
Other metro	18
Non-metro	22
Population estimate	22

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who believe that refrigeration completely stops bacterial growth. (Survey B, p. 129)

KNOWLEDGE

Process 2: Home Storage of Meat and Poultry

Control Zone 5: Freezing

Step 20: If freezer fails, within two days, refreeze, cook, or discard products.

TABLE 4. Ignorance of the Effect of Freezing on Bacteria

<u>Education</u>	Believe that freezing kills bacteria * (National Survey) Percent
Grade school or less	28
Some high school	22
High school graduate	20
Any college	13
<u>Family Income</u>	
Under \$3,000	32
\$3,000 to \$5,999	23
\$6,000 to \$9,999	21
\$10,000 to \$14,999	21
\$15,000 and over	13
Population estimate	20

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who believe that freezing will kill any bacteria that may cause food poisoning. (Survey B, p. 123)

KNOWLEDGE

Process 3: Preparation of Meat and Poultry

Control Zone 7: Preliminaries

TABLE 5. Ignorance of Bacteria in
Raw Meat and Poultry

<u>Age</u>	Believe that meat and poultry do not carry bacteria	
	(National Survey)* Percent	(Kansas Survey)** Percent
19-28		27
29-37		18
38-55		15
56 or older		25
<u>Education</u>		
Grade school or less	57	
Some high school	56	27
High school graduate	67	27
Any college	64	17
Population estimate	63	20

Note: Population estimate is the percent of the sample as a whole,
i.e. with no subgroupings.

* Percent who believe that meat and poultry when bought is not at all
likely or too likely to carry harmful bacteria. (Survey B, p. 97)

** Percent who believe that meat and poultry generally do not contain
bacteria. (Survey D, p. 30)

KNOWLEDGE

Process 3: Preparation of Meat and Poultry

Control Zone 7: Preliminaries

Step 1: Wash hands...after handling raw meat and poultry.

TABLE 6. Ignorance of Cross Contamination

<u>Community Size</u>	Would not wash hands and utensils after <u>handling raw meat *</u> (National Survey) Percent
Metro areas over 1 million	65
Other metro	60
Non-metro	55
<u>Region</u>	
Northeast	65
North Central	60
South	53
West	64
Population estimate	60

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who would not wash knife, cutting board, and hands after handling raw meat and before cutting vegetables for salad. (Survey B, p. 88)

KNOWLEDGE

Process 3: Preparation of Meat and Poultry

Control Zone 7: Preliminaries

Step 3: Wear clean glove or clean bandage over skin cuts.

TABLE 7. Ignorance of Staphylococcal Contamination

<u>Age</u>	Not concerned that a cut <u>would contaminate meat *</u> (National Survey) Percent
Under 30	37
30 to 49	43
50 to 64	48
65 and over	51
<u>Education</u>	
Grade school or less	53
Some high school	43
High school graduate	41
Any college	43
<u>Region</u>	
Northeast	46
North Central	49
South	37
West	47
Population estimate	45

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who were not concerned that a cut would contaminate meat. (Survey B, p. 108)

KNOWLEDGE

Process 3: Preparation of Meat and Poultry

Control Zone 7: Preliminaries

Step 6: Do not thaw at room temperature.

TABLE 8. Ignorance of the Effect of Room
Room Temperature on Bacteria

<u>Age</u>	Not concerned about raw meat and poultry standing <u>at room temperature</u> (National Survey)*	Do not know that bacteria grow rapidly <u>at room temperature</u> (National Survey)**
	Percent	Percent
Under 30	15	
30 to 49	11	
50 to 64	10	
65 and over	13	
<u>Education</u>		
Grade school or less		15
Some high school		12
High school graduate		7
Any college		5
<u>Family Income</u>		
Under \$3,000		15
\$3,000 to \$5,999		12
\$6,000 to \$9,999		11
\$10,000 to \$14,999		8
\$15,000 and over		4
<u>Region</u>		
Northeast	12	
North Central	12	
South	8	
West	19	
Population estimate	12	9

Note: Population estimate is the percent of the sample as a whole,
i.e., with no subgroupings.

* Percent not concerned about uncooked meat and poultry standing at room
temperature for 2 to 3 hours. (Survey B, p. 130)

** Percent who do not know that bacteria in food grow rapidly at room
temperature. (Survey B, p. 125)

KNOWLEDGE

Process 3: Preparation of Meat and Poultry

Control Zone 7: Preliminaries

Step 8: Stuff product immediately before cooking.

TABLE 9. Ignorance of Stuffing Procedures

<u>Age</u>	Do not know to stuff <u>product just before roasting *</u> (National Survey)
	Percent
Under 30	17
30 to 49	10
50 to 64	8
65 and over	9
Population estimate	11

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who do not know that meat and poultry should be stuffed just before roasting. (Survey B, p. 124)

PRACTICE

Process 3: Preparation of Meat and Poultry

Control Zone 8: Initial Cooking by Consumer

Step 12: Use (safe method) to determine doneness of meat and poultry two inches or less in thickness. (Expanded to include: cook to a safe internal temperature).

TABLE 10. Risky Cooking Practices

<u>Education</u>	Cook ground beef to <u>unsafe temperature *</u> (National Survey) Percent
Grade school or less	9
Some high school	13
High school graduate	14
Any college	22
<u>Family Income</u>	
Under \$3,000	14
\$3,000 to \$5,999	8
\$6,000 to \$9,999	13
\$10,000 to \$14,999	14
\$15,000 and over	20
<u>Community Size</u>	
Metro areas over 1 million	21
Other metro	13
Non-metro	9
<u>Region</u>	
Northeast	19
North Central	15
South	9
West	19
Population estimate	14

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who serve ground beef rare or medium rare. (Survey B, p. 32)

KNOWLEDGE

Process 4: Serving Meat and Poultry

Control Zone 9: Room Temperature Holding

Step 4: Leave out cooked food no longer than 2 hours before refrigerating, freezing, or reheating.

TABLE 11. Ignorance of Room Temperature Holding
Risks for Cooked Food

<u>Age</u>	Believe that food should cool before <u>it is refrigerated*</u> (National Survey) Percent	Not concerned about cooked meat and poultry standing at room <u>temperature**</u> (National Survey) Percent
Under 30	65	49
30 to 49	60	45
50 to 64	69	48
65 and over	74	43
<u>Education</u>		
Grade school or less	78	46
Some high school	76	54
High school graduate	64	48
Any college	49	38
<u>Family Income</u>		
Under \$3,000	77	
\$3,000 to \$5,999	74	
\$6,000 to \$9,999	68	
\$10,000 to \$14,999	64	
\$15,000 and over	53	
<u>Community Size</u>		
Metro areas over 1 million	64	44
Other metro	61	46
Non-metro	70	50
<u>Region</u>		
Northeast		44
North Central		43
South		52
West		45
Population estimate	66	46

Note: Population estimate is the percent of the sample as a whole,
i.e., with no subgroupings.

* Percent who believe that food should be left to cool at room temperature
before refrigerating. (Survey B, p. 126)

** Percent not concerned about cooked meat and poultry standing at room

BEHAVIOR

Process 4: Serving Meat and Poultry

Control Zone 9: Room Temperature Holding

Step 4: Leave cooked food at room temperature no longer than 2 hours.

TABLE 12. Risky Room Temperature Holding Practices

	Left Cooked Food at Room Temperature Over two hours* (National Survey) Percent			
	<u>Turkey</u>	<u>Roast Beef</u>	<u>Pork Roast</u>	<u>Meat Salad</u>
<u>Age</u>				
Under 30	19	10	6	42
30 to 49	27	14	8	35
50 to 64	22	17	8	24
65 and over	14	12	7	7
<u>Education</u>				
Grade school or less	15	12	8	15
Some high school	24	15	8	23
High school graduate	24	14	7	36
Any college	23	13	5	35
<u>Family Income</u>				
Under \$3,000	11	9	5	10
\$3,000 to \$5,999	18	12	7	16
\$6,000 to \$9,999	23	13	8	30
\$10,000 to \$14,999	24	13	7	38
\$15,000 and over	26	18	6	36
<u>Community Size</u>				
Metro areas over 1 million	25			33
Other metro	20			33
Non-metro	21			22
<u>Region</u>				
Northeast	22	14	6	37
North Central	18	9	6	24
South	24	17	9	25
West	24	13	5	34
Population estimate	22	13	7	29

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who left cooked turkey, roast beef, pork roast, meat salad at room temperature over two hours. (Survey B, p. 7)

KNOWLEDGE

Process 5: Handling Leftovers

Control Zone 12: Sanitation

Step 3: Remove stuffing before cooling or freezing.

TABLE 13. Ignorance of Safe Storage of Leftover Stuffing

Believe that stuffing can
be stored safely in Turkey*
(National Survey)

Education

Grade school or less	42
Some high school	38
High school graduate	30
Any college	22

Family Income

Under \$3,000	47
\$3,000 to 5,999	34
\$6,000 to \$9,999	34
\$10,000 to \$14,999	29
\$15,000 and over	24

Region

Northeast	33
North Central	27
South	40
West	22

Population estimate	32
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Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who believe that it is safe to store stuffing in turkey.
(Survey B, p. 128)

PRACTICE

Process 5: Handling Leftovers

Control Zone 14: Reheating Cooked Leftovers

Step 9: Cover and reheat leftovers to appropriate temperature.

TABLE 14. Risky Practice of Reheating Leftover Gravy

<u>Education</u>	Heated gravy to unsafe
	<u>Temperature*</u>
	(National Survey) Percent
Grade school or less	25
Some high school	26
High school graduate	27
Any college	17
 <u>Region</u>	
Northeast	34
North Central	23
South	19
West	19
 Population estimate	 24

Note: Population estimate is the percent of the sample as a whole, i.e., with no subgroupings.

* Percent who heated gravy less hot than simmer. (Survey B, p. 82)

APPENDIX E: EXPERT COMMENTS

Appendix E includes substantive comments on the issues and advice statements in the inventory [other than comments included in Table 8 (Food Safety Issues) and Table 9 (Care Labeling)]. Several commenters made marginal comments. Also, individuals were asked if any behaviors important in preventing foodborne illness had been left out of the inventory, or if they had any additional general comments.

All comments have been synthesized, organized by topic. Comments relating merely to question clarity have been excluded from this list, although they were considered in analysis.

Codes in parentheses identify commenters. For example, (E-01) would indicate one of the expert panel of microbiologists; (A-02) a member of the National Advisory Committee on Microbiological Criteria for Foods; (B-03) an epidemiologist with the Meatborne Hazard Control Center; and (C-04) one of the selected consumer experts.

Planning

Plan to buy from reputable source with no record of unsafe handling.

"Since there is no requirement for safety assurance education or HACCP in food production, no one can be assumed to have control." (E-08)

[A large percentage of consumers practice this behavior] "when economically possible." (C-01)

"Limited ways to know." (C-02)

Choosing food

Buy packaged meat and poultry only if packaging is sound (examples: undented cans, refrigerated/frozen products without tears in packaging).

"The problem is more what happened in processing." (E-08)

[Consumers do this] "when economically possible." (C-01)

Buy products labeled "keep refrigerated" only if they are stored in a refrigerated meat case."

"Probably rely on store to properly display." (C-01)

Buy frozen products only if they appear frozen solid to the touch.

"Does it meet definition re illness problem (or quality)?" (C-02)

Buy products from deli refrigerated display cases only if unpackaged products are not in contact with other unpackaged raw or cooked products.

"Cooked products should not be placed in contact with raw products!" (E-01)

"The critical control point is cross-contamination on the slicing machine. Spoilage bacteria control this problem." (E-08)

"Not OK if cooked in contact with raw." (A-03)

Place meat and poultry packages in individual plastic bags.

"Not always available." (C-01)

Place meat, poultry, cold foods in shopping cart last.

"Mainly because of where located in store." (C-01)

Open dating

Buy "open dated" products only if label sell-by, use-by, or pull-by date has not expired."

"Not a safety issue per definition." (C-02)

Date undated products so they can be used within a safe time limit that will also assure quality (see Safe Food Book, p. 14).

"Refrigerated storage (40 degrees F) is limited by quality concerns before safety with a few exceptions (lightly smoked fish)." (C-02)

"'Safe time limit' does not convey consumers' confusion on what that might be. Some are more conservative and discard foods before they need to, others hold and use foods beyond recommended 'safe' time frame." (C-01)

"Quality is primary concern." (C-05)

"Not safety re definition." (C-02)

Use dated or undated products within safe time limit.

"Does not convey consumer confusion over what 'safe time limit' might be. Some are more conservative and discard foods before they need to, others hold and use foods beyond recommended 'safe' time frame." (C-01)

"Not safety re definition." (C-02)

Date leftovers to allow use within safe time period (see Appendix for Safe Food Book, p. 14 chart on Cold Storage).

"Not safety re definition." (C-02)

Reporting problems

Report problems with packaging, product, storage, sanitation to store management or, if unsatisfied, to local health authorities.

"This should be done to improve future safety but it will not impact present individual safety." (E-01)

"How will reporting affect microbial risk?" (E-02)

"Very little chance of improvement because of cost to industry and lack of local government interest." (E-08)

"Two parts--report to management, report to health. [Consumers have] low awareness of who is responsible beyond store management." (C-01)

"Yes--important." (B-01)

Transporting food

Consider outside temperature in planning trip.

"Particularly [for] deli items." (E-08)

In climate temperatures 70 degrees F or below, hold cold foods at 40 degrees F in vehicle or plan to place in cold storage within two hours. [advice statement later changed]

"How does one place food at 40 degrees F in vehicle?" (E-01)

"This depends on how it is wrapped and what bulk for cooling." (E-08)

Hold hot foods above 140 degrees F in vehicle, OR plan to reheat or place in cold storage within one hour. [advice statement later revised]

"How does one hold food at 140 degrees F in vehicle?" (E-01)

If climate temperature is above 70 degrees F or distance is more than 30 miles, use ice chest for cold items. [final advice statement revised.]

"I don't transport on ice every time I go to the store in the summer." (E-06)

"I assume it is packed with ice." (E-08)

"If do practice, only to avoid thawing of frozen foods -- not safety concerns." (C-01)

Sanitation and personal hygiene, cross-contamination

General: "More stress on cross-contamination, water sources" [needed].
(C-05)

"Cross-contamination more specific." (A-06)

Wash hands with soap and water for 20 seconds before re-wrapping products whose packaging was damaged during transport.

[for refrigeration] "Control point is washing hands after handling raw product."
(A-05)

[for freezing] "The key control is to wash the fecal material out from under the fingernails and off the fingertips." (E-08)

Wear clean plastic gloves over skin cuts.

"The cut is only a problem if infected. Then it would be a 5." [5= very high risk] (E-08)

"Major risk is infection to cut, not contaminating the raw meat." (A-03)

Clean counters, equipment, utensils with soap and water immediately after use.

"It depends on sanitizing BEFORE you use it." (E-08)

"And immediately before use." (B-01)

Wash hands with soap and water for 20 seconds before eating cooked foods.

"I assume you use a knife and fork." (E-08)

Serve cooked products on clean plates and with clean utensils and clean hands.

"The hands are the only problem unless a plate was used to hold raw product and not washed." (E-08)

Avoid dipping personal spoon in serving dish.

"Same hazard as common cup at church communion." (E-08)

[not a hazard,] "except for Hepatitis A." (A-01)

"Especially in family situations." (C-01)

[When handling leftovers] Use clean surfaces and utensils.

"Depends on contamination--what if utensil is serving utensil?" (E-02)

"This is very important." (B-01)

Refrigeration

General: "I don't think the questions as stated will show the actual misconceptions that consumers have on storage safety -- either in the refrigerator or freezer." (C-01)

"Nowhere do you deal with the terrible refrigerators and very slow cooling even in good refrigerators. This is the MAJOR critical control point." (E-08)

Use refrigerator thermometer to verify temperature of 40 degrees F or colder.

"Where did you measure this temp? Below 50 is probably enough." (E-08)

Refrigerate products with "keep refrigerated" label.

[Most consumers do so] "unless product not traditionally packaged." (C-01)

Maintain a clean refrigerator.

"What does 'clean' mean?" (E-02)

"This is a spoilage problem." (E-08)

[Does] "not meet definition re illness concern." (C-02)

If refrigerator fails, keep door closed and, within 6 hours, cook products, OR place in environment 40 degrees F or colder.

"Or discard." (A-01)

Refrigerate or freeze cooked leftovers in small, covered, shallow containers within two hours after cooking.

"I assume you mean get the temperature to below 40 degrees F in 2 hr." (E-08)

"Improper cooling of masses of food is the single most important cause of food poisoning." This respondent also suggested breaking the behavioral statement into two parts, because combining both (a) refrigeration in 2 hours after cooking and (b) in small, shallow, covered containers "does not emphathize 'small, covered, shallow', which is extremely important." (A-08)

"Maybe more [refrigerate] within 2 hours, but probably use larger containers." (C-01)

Freezing

Use freezer wrap, aluminum foil, freezer bag or other sound packaging over commercial wrap to prevent juices from contaminating other foods or freezer surfaces.

[Consumers] "may wrap as described, but quality, not safety concern." (C-01)

Keep freezer at 0 degrees F or colder.

"Not safety concern." (C-02)

Freeze foods with "keep frozen" label.

"Store refrigerated until used." (E-05)

"Not safety concern." (C-02)

Freeze raw meat and poultry that will not be used within 2 days.

"Not safety re definition." (C-02)

Store meat and poultry in back of freezer, rather than in door.

"Not safety re definition." (C-02)

Maintain a clean freezer.

"What does 'clean' mean?" (E-02)

"Not safety re definition." (C-02)

If freezer fails, within two days refreeze, cook or discard products.

"Depending on freezer location, contents may be hazardous in less than two days." (E-05)

"Depends." (E-11)

Avoid refreezing leftovers that have been frozen, thawed and reheated.

"Depends on how fast it was done." (E-08)

"Quality not safety -- see definition." (C-02)

Thawing

Thaw only in refrigerator, under cold running water, or in microwave (followed by immediate cooking).

"Depends." (E-11)

"Or [thaw in] oven. (B-01)

Marinating

Marinate raw product in refrigerator.

"Depends on the chemistry of the marinade. I assume a pH of 6.0." (E-08)

"Depends." (E-11)

Stuffing (cross-contamination, time-temperature abuse)

Stuff raw product immediately before cooking.

"Depends on the temp. of the stuffing. If stuffing greater than 70 degrees F then very hazardous. If stuffing less than 45 degrees F then 3." [3=moderate risk] (E-08)

"Hazard identification?" (C-02)

Remove stuffing before cooling or freezing meat or poultry.

"May be lower for foods other than poultry -- examples, stuffed chops, casseroles." (C-01)

Cooking, general

General: All the way through, you must give time and temperature for each step." (E-08)

Avoid tasting foods in process.

"It depends on the food. Greater than 165 degrees no hazard." (E-08)

Avoid interrupted cooking.

"How long?" (A-01)

"Yes!" (B-01)

Judging doneness

Use meat thermometer to judge safe internal temperature of meat and poultry over two inches thick (160 degrees F or higher for beef and pork, 180 degrees F or higher for poultry). Also see Appendix for Safe Food Book, p. 11 chart on cooking)

"We do not agree with your reduction from 170 degrees to 160 degrees F for pork." (E-01)

"It is post cooking handling that [is] the problem." (E-08)

"Evidence why not [poultry] 160 degrees F?" (C-02)

"Or cook for extra long period of time." (B-01)

Use recipe, internal meat or juice color to determine doneness of meat and poultry two inches or less in thickness. [advice statement later revised.]

"Internal meat color and juice color not adequate." (E-01)

"These seem to be different circumstances to indicate safety, and assume that consumer uses information correctly. Recipe might be used, but depending on recipe may be very unsafe. Color of juice might be used -- but consumer may like and eat ground beef when juice runs red, for example." (C-01)

"Strongly recommend 11[use of meat thermometer] over 12 [visual observation]." (B-01)

Microwaving

Use rotating microwave pad (or similar energy dispersion device) if microwaving.

"We do not recommend cooking meat in a microwave oven." (E-01)

"Don't like [microwave] use on raw foods." (E-02)

"Manual [rotation] is OK, too." (A-03)

[Rotational pad] "not widely available." (C-01)

Use microwave temperature probe if microwaving.

"We do not recommend cooking meat in a microwave oven." (E-01)

"Don't like [microwave] use on raw foods." (E-02)

"The food must be covered to pasteurize the surface. This is the ccp." [critical control point] (E-08)

"Regular thermometer check is OK, too." (A-03)

Based on microwave cooking directions, increase microwaving time if necessary for product to reach safe temperature.

"We do not recommend cooking meat in a microwave oven." (E-01)

Let microwaved food stand for recommended number of minutes before serving.

"We do not recommend cooking meat in a microwave oven." (E-01)

Slow cooking

^(R)
Use Crockpots, smokers, or slow cookers according to label directions.

"You must measure temperature. No directions have been HACCP'd in the U.S. yet." (E-08)

"Using these appliances according to directions does not always indicate a safe practice. I've seen very unsafe recipes and uses for crockpots or smokers, for example. Or time-bake feature of oven is unsafe for meats and poultry." (C-01)

Hot holding

Hold hot food above 140 degrees F.

"130 degrees F or greater is OK." (A-09)

"For how long?" (C-07)

Room Temperature Holding

General: Issue of cooling down hot foods before refrigerated storage (or freezing) is not really addressed except in question #4 in Process 5. I think there are major misconceptions in this area." (C-01)

In environmental temperatures 90 degrees F or above, leave out cooked food no longer than 1 hour before refrigerating, freezing, or reheating.

"One hour is conservatively safe." (A-03)

"It takes at least 4 hours for Staphylococcus aureus to produce enterotoxin. [At these temperatures,] two hours would be a 4, three hours would be a 5." [4= high risk; 5= very high risk.] (A-04)

In environmental temperatures below 90 degrees F, leave out cooked food no longer than 2 hours before refrigerating, freezing, or reheating.

"Two hours is conservatively safe." (A-03)

[At these temperatures,] "two hours would be a 3, and four hours would be a 4 or 5." [3= moderate risk; 4= high risk; 5= very high risk.] (A-08)

"These times seem to be arbitrary. I would not leave the product out for 2 hours in environmental temperatures." (B-01)

Reheating

General: "Avoid eating processed meats intended to be cooked (hot dogs)." [without reheating first] (A-01)

Cover and reheat leftovers to appropriate temperature before serving (a rolling boil for sauces, soups, gravies, "wet" foods; 165 degrees F for all others).

"If all the previous steps were done safely, then this is not necessary." (E-08)

"This [165 degrees F] should be 185 degrees F for the housewife to attain 165 degrees F center temperature." (A-08)

"Low [knowledge], due to specified temperatures. Low [practice] due to microwave warm-up." (C-01)

"Not necessary -- correctly stored leftovers can be eaten cold." (C-02)

Disposal

Properly dispose of outdated or other potentially unsafe frozen or refrigerated products in a way that prevents consumption by humans or animals.

"People often suggest feeding these foods to animals rather than discarding." (C-01)

"Does not meet definition of safety." (C-02)

It is apparent that some individuals made more comments than others on items in the inventory. Although the identity of the individuals is confidential, the number of comments by each is listed below.

Expert Panel of Microbiologists

E-01	10 comments
E-02	6 comments
E-05	2 comments
E-06	1 comment
E-08	26 comments

Consumer Experts

C-01	18 comments
C-02	18 comments
C-05	1 comment
C-07	1 comment

National Advisory Committee on Microbiological Criteria for Foods

A-01	4 comments
A-03	6 comments
A-04	1 comment
A-05	1 comment
A-06	1 comment
A-08	3 comments
A-09	1 comment

MBHCC epidemiologists

B-01	8 comments
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